

*Cranfield University*  
*School of Management*



PhD Thesis

Academic Year of 1997/98

Mário Caldeira

Understanding the adoption and use of  
information systems /information technology in  
small and medium-sized manufacturing enterprises:  
A study in Portuguese industry

Supervisor: Prof. John Ward

September 1998

This thesis is submitted in partial fulfilment of the requirements  
for the Degree of Doctor of Philosophy

CRANFIELD UNIVERSITY



MÁRIO CALDEIRA

UNDERSTANDING THE ADOPTION AND USE OF  
INFORMATION SYSTEMS / INFORMATION TECHNOLOGY  
IN SMALL AND MEDIUM-SIZED MANUFACTURING ENTERPRISES:  
A STUDY IN PORTUGUESE INDUSTRY

SCHOOL OF MANAGEMENT

PhD THESIS

## **Abstract**

This research analysed factors and sets of factors that affect and explain the varying levels of success in the adoption and use of IS/IT (Information Systems/Information Technology) in Portuguese manufacturing SMEs (Small and Medium-sized Enterprises). The study set out to fill a gap in knowledge not covered by previous research into the area of IS/IT in SMEs. Existing work was found to be of limited relevance or was out-of-date, due to the rapid evolution of IS/IT, and did not address the Portuguese context.

The study followed a realist approach to social enquiry. Seeking to explain IS/IT success, it is necessary to understand the perspectives and social relationships amongst the key actors involved in the process of IS/IT adoption and use. Case study research was undertaken in twelve SMEs operating in the Portuguese manufacturing industry. A total of 56 interviews were conducted with top managers, IS/IT managers, IS/IT staff, and IS/IT suppliers. The factors identified as associated with IS/IT success were clustered into four categories according to their perceived relevance. Interrelationships amongst factors were established and the common patterns across firms with similar levels of IS/IT adoption and success were analysed.

This research demonstrates that a combination of factors were determinant to explain IS/IT adoption and success. These are related to the involvement of the top managers in the process of IS/IT adoption and use, and to the development of IS/IT competencies, in-house or in associated IS/IT suppliers. Of particular importance is the presence of an individual in the firm with IS/IT knowledge, CEO trust, and a view on how to incorporate IS/IT in the strategic development of the firm. In the SMEs that were more successful in adopting and using IS/IT, the establishment of co-operative links with IS/IT suppliers was essentially based on personal relationships or ownership of the IS/IT enterprise, rather than on contractual relationships. The findings were validated by comparison with existing theory, and resource-based theory was found to provide a coherent explanation of the results of the empirical work.



## Acknowledgements

The realisation of this research was supported by a large number of people who contributed in their particular ways, without whom this research would not have been possible.

Foremost, I would like to express my very special gratitude to John Ward for his excellent supervision, commitment and personal support.

I also would like to thank:

Vitor Gonçalves, my second supervisor in Lisbon, for the support given to the research; Karin Breu, Andy Bytheway, David Grimshaw, and Gurpreet Dhillon for their comments on the work;

Christine Afflick, Frances Sutherland, and specially Alex Britnell for the time and effort spent in the difficult task of proof reading;

The members of the review panels, Sue Vinnicombe, Cliff Bowman, and Shai Vyakarnam, for their comments and suggestions;

Henrique O'Neill, for the time and effort spent checking the translations of the data collected in the interviews;

Professors and colleagues in Portugal that in one way or another collaborated in the research, by providing access to enterprises or by giving comments on the subject: Ana Lucas, Almiro de Oliveira, João Álvaro Carvalho, Luis Amaral, Luis Lima, Mário Romão, Rodrigo de Magalhães and, specially, Carlos Zorrinho and Amílcar Gonçalves for their important support all over these years;

My fellow students at Cranfield, particularly Ron Tasker, Gilles Spony and Richard Ford for the time spent discussing the subject and all the good time spent together during my stay at Cranfield;

The research participants, for the access provided, time spent, and interest discussing the subject;

JNICT, *Junta Nacional de Investigação Científica e Tecnológica*, for funding the research;

My wife, Odete, for all the time we were not together and for her patience with a preoccupied husband;

Last, a very special thanks to Henrique Teles Marcelino, who is no longer amongst us but will never be forgotten, for his friendship as well as his very strong commitment to established IS research in Portugal, without whom the study would not have been possible.

*Mário Caldeira*  
*Cranfield, September 1998.*



# CONTENTS

## CHAPTER 1 - Introduction

1.1 Research rationale .....	1
1.2 Research context .....	2
1.3 Research scope and objectives .....	5
1.4 Thesis structure .....	8

## CHAPTER 2 - IS/IT success factors in SMEs: A literature review

2.1 Introduction .....	10
2.2 The concept of information systems / information technology .....	10
2.3 The concept of Small and Medium-sized Enterprise (SME) .....	11
2.4 Concepts and measures of IS/IT success in SMEs .....	16
2.5 A research framework to study IS/IT adoption and success in SMEs .....	22
2.5.1 The initial framework for analysis of IS/IT adoption and success in SMEs .....	22
2.5.2 Summary of the key literature on IS/IT success and adoption in SMEs .....	23
2.5.3 The research framework .....	29
2.6 Factors related to the <i>Internal Context</i> .....	30
2.6.1 Resource availability .....	30
2.6.2 Management perspectives and attitudes towards IS/IT adoption and use .....	30
2.6.3 IS/IT competencies .....	38
2.6.4 Organisational structure .....	39
2.6.5 Power relationships and user attitudes .....	42
2.7 Factors related to the <i>External Context</i> .....	43
2.7.1 External expertise .....	43
2.7.2 IS/IT availability .....	44
2.7.3 Business environment .....	45
2.8 Factors related to the <i>Process</i> .....	47
2.8.1 Stages, methods, techniques and frameworks used in IS/IT development .....	47
2.8.2 People involved in the process of IS/IT adoption .....	48
2.8.3 IS/IT training .....	49
2.9 Factors related to the <i>Content</i> .....	49
2.9.1 Type of IS/IT .....	49
2.9.2 IS/IT objectives and assumptions .....	50
2.9.3 Evaluation of IS/IT .....	51

2.9.4 Time of IS/IT adoption .....	51
2.10 Critique of the literature about IS/IT success factors in SMEs .....	52

### **CHAPTER 3 - Initial fieldwork and development of the research framework**

3.1 Objectives of the initial fieldwork .....	54
3.2 The enterprises studied in the initial fieldwork .....	55
3.2.1 Firm A .....	55
3.2.2 Firm B .....	57
3.2.3 Firm C .....	61
3.2.4 Firm D .....	63
3.2.5 Firm E .....	65
3.2.6 Firm F .....	67
3.2.7 Firm G .....	68
3.3 Discussion of the findings from the initial fieldwork .....	72
3.4 Interdimensional relationships .....	77
3.4.1 Context / Process .....	77
3.4.2 Context / Content .....	78
3.4.3 Process / Content .....	78
3.5 Summary of the initial findings and initial propositions for research .....	79
3.6 The framework to study IS/IT adoption and use in SMEs .....	81
3.7 Summary .....	84

### **CHAPTER 4 - Philosophical perspective and research strategy**

4.1 Introduction .....	87
4.2 Philosophical perspective .....	87
4.2.1 Positivism .....	88
4.2.2 Interpretivism .....	89
4.2.3 Realism .....	90
4.3 Research strategy .....	94
4.3.1 Selecting a research strategy .....	94
4.3.2 The positivist and interpretive approaches to case study research .....	97
4.3.3 A realist perspective of case study .....	98
4.4 Research Design .....	103
4.4.1 Overall strategy .....	103
4.4.2 Case study selection criteria .....	105
4.4.3 Data collection method .....	106



4.4.4 Data analysis method .....	107
4.5 Summary .....	110

## **CHAPTER 5 – Case studies summaries**

5.1 Introduction .....	111
5.2 Case study 1 .....	113
5.3 Case study 2 .....	128
5.4 Case study 3 .....	136
5.5 Case study 4 .....	144
5.6 Case study 5 .....	150
5.7 Case Study 6 .....	158
5.8 Case study 7 .....	164
5.9 Case study 8 .....	170
5.10 Case study 9 .....	178
5.11 Case study 10 .....	189
5.12 Case study 11 .....	197
5.13 Case study 12 .....	203
5.14 Conclusion .....	209

## **CHAPTER 6 - Cross-case data analysis**

6.1 Introduction .....	210
6.2 A view about IS/IT success .....	210
6.3 The structure of the analysis .....	214
6.4 Data analysis by cluster .....	215
6.4.1 <i>Cluster A</i> (firms 1, 2 and 11) .....	215
6.4.2 <i>Cluster B</i> (firms 3 and 12) .....	220
6.4.3 <i>Cluster C</i> (firms 4, 5, 7 and 10) .....	221
6.4.4 <i>Cluster D</i> (firms 6, 8 and 9) .....	227
6.4 Cluster sensitivity analysis .....	231
6.5 Initial findings from cluster analysis .....	234
6.6 Factor analysis .....	234
6.7.1 Situational factors .....	236
6.7.2 Determinant factors .....	240
6.7.3 Consequent factors .....	246
6.7.4 Not significant factors .....	250
6.8 Analysis of the findings .....	251



6.8.1 Summary of cluster and factor analysis.....	251
6.8.2 Analysis of factor interrelationships .....	252
6.8.3 Discussion of the determinant factors of IS/IT success.....	253
6.8.4 Discussion of the findings in relation to the initial research propositions.....	265
6.8.5 Summary and conclusions .....	269

## **CHAPTER 7 - Theoretical validation of the findings**

7.1 Introduction .....	271
7.2 Transaction cost theory .....	271
7.3 The essence resource-based theory.....	274
7.4 The use of resource-based theory in the field of information systems.....	277
7.5 A resource-based approach to understand IS/IT adoption and use in manufacturing SMEs.....	278
7.6 Comparing the findings with previous SME literature .....	281
7.7 A resource-based model to understand the successful adoption and use of IS/IT in manufacturing SMEs .....	283
7.8 Summary and conclusions .....	285

## **CHAPTER 8 - Research conclusions**

8.1 Summary of research overtaken.....	287
8.2 Key research findings.....	289
8.2.1 Research question 1 .....	289
8.2.2 Research question 2 .....	290
8.3 Contribution to knowledge.....	294
8.3.1 Research subject .....	294
8.3.2 Research context .....	294
8.3.3 Research method .....	295
8.4 Limitations of the study and opportunities for further research .....	295

<b><u>BIBLIOGRAPHY</u></b> .....	297
----------------------------------	-----

## **APPENDICES**

Appendix A - Case study structure (check-list).....	317
Appendix B – The questionnaire .....	322

# LIST OF FIGURES

## Chapter 1

Fig. 1.1 Research Context Model .....	6
---------------------------------------	---

## Chapter 2

Fig. 2.1 IS/IT success model .....	18
Fig. 2.2 Understanding strategic change .....	22
Fig. 2.3 The initial fieldwork for analysis of IS/IT in SMEs .....	29

## Chapter 3

Fig. 3.1 Structure for data collection and data analysis in <i>NUD*IST</i> .....	82
--	----

## Chapter 4

Fig. 4.1 Research map .....	101
Fig. 4.2 The stages of the research .....	104
Fig. 4.3 Case study selection criteria .....	106
Fig. 4.4 The use of <i>NUD*IST</i> in data analysis .....	107

## Chapter 6

Fig. 6.1 The clusters for analysis .....	214
Fig. 6.2 Alternative clusters .....	231
Fig. 6.3 Classification of factors associated with IS/IT success .....	235
Fig. 6.4 Factors affecting IS/IT adoption and success .....	253
Fig. 6.5 Relationships between key actors in cluster A .....	255
Fig. 6.6 Patterns of interactions between key actors in the process of IS/IT adoption and use – Cluster A .....	256
Fig. 6.7 Relationships between key actors in cluster D .....	258
Fig. 6.8 Patterns of interactions between key actors in the process of IS/IT adoption and use – Cluster D .....	259
Fig. 6.9 Relationships between key actors in cluster B .....	260
Fig. 6.10 Patterns of interactions between key actors in the process of IS/IT adoption and use – Cluster B .....	261
Fig. 6.11 Relationships between key actors in cluster C .....	262
Fig. 6.12 Patterns of interactions between key actors in the process of IS/IT adoption and use – Cluster C .....	263

Fig. 6.13 The influence of management involvement in IS/IT adoption and success .....	264
---	-----

## **Chapter 7**

Fig. 7.1 Relationships between capabilities, competencies, skills and knowledge. ...	276
Fig. 7.2 Analysis of the determinant factors of IS/IT success .....	280
Fig. 7.3 Analysis of the determinant factors and their link to the SME literature ....	282
Fig. 7.4 A resource-based model to understand the successful adoption and use of IS/IT in manufacturing SMEs .....	283

## **Chapter 8**

Fig. 8.1 The clusters for analysis .....	288
Fig. 8.2 Classification of the factors associated with IS/IT adoption and success ...	290
Fig. 8.3 Relationships amongst factors affecting IS/IT adoption and success .....	291
Fig. 8.4 A resource-based model to explain the successful adoption and use of IS/IT in manufacturing SMEs .....	292

# **LIST OF TABLES**

## **Chapter 2**

Table 2.1 Summary of the literature on IS/IT adoption and success in SMEs .....	24
---	----

## **Chapter 3**

Table 3.1 Comparing the most relevant literature with preliminary fieldwork findings .....	74
Table 3.2 Initial propositions for case study analysis .....	80
Table 3.3 Cross-references of initial propositions to case study check-list .....	83

## **Chapter 5**

Table 5.1 Characteristics of the firms involved in case study research .....	112
Table 5.2 <i>FIRM 1</i> : summary .....	127
Table 5.3 <i>FIRM 2</i> : summary .....	135
Table 5.4 <i>FIRM 3</i> : summary .....	143
Table 5.5 <i>FIRM 4</i> : summary .....	149



Table 5.6 *FIRM 5*: summary .....157

Table 5.7 *FIRM 6*: summary .....163

Table 5.8 *FIRM 7*: summary .....169

Table 5.9 *FIRM 8*: summary .....177

Table 5.10 *FIRM 9*: summary .....188

Table 5.11 *FIRM 10*: summary .....196

Table 5.12 *FIRM 11*: summary .....202

Table 5.13 *FIRM 12*: summary .....208

**Chapter 6**

Table 6.1 Firms in cluster A .....218

Table 6.2 Firms in clusters B and C .....223

Table 6.3 Firms in cluster D .....229

# **Chapter 1**

## **Introduction**

### **1.1- Research rationale**

The introduction of information technology (IT) in organisations, and particularly in small and medium-sized enterprises (SMEs) in traditional industries, is likely to have a significant impact within the organisation. Information technology can be used in restructuring organisational activity, in improving workers' co-ordination and interpersonal relationships (Turner, 1998), and in strengthening the competitive position of the firm (Ward and Griffiths, 1996).

In spite of the continuous improvement in information technology, both its economics and its capabilities, the effectiveness of computer systems in organisations is frequently below expectations. For example, according to Liebenau and Backhouse (1990: p.119), "large amounts of money have been spent developing computer systems which may operate correctly but are ineffective for their real purposes". Frequently, the social impact of information technology in organisations is underestimated and not completely perceived by managers. Although the technological perspective is the dominant perspective and the human and social dimension is less considered, some literature stresses the importance of the social aspects of technology rather than the technical ones (Checkland and Scholes, 1990; Knights and Murray, 1994; Walsham, 1993). As Backhouse and Land (1994: p.20) state, "as practitioners we have realised that some of the problems using the technology effectively stem from political, organization and social problems".

Information technology is a relatively recent technology, characterised by an exponential development and strong social and organisational impact. Compared with large enterprises, SMEs usually have lower financial resources, less technological expertise and poor management skills (Blili and Raymond, 1993), and started to use information technology more recently. This fact explains to some degree the lack of research about information technology adoption and success in SMEs, especially in less developed countries.

In a review of the literature about IT trends in small businesses, Doukidis *et al.* (1994: p.15) concluded that "the introduction of IT into small firms in less developed national IT environments has received little attention in the literature". Other researchers have announced similar conclusions. For example, Kaye (1990: p.73) expresses the view that



research about factors influencing information systems success “is dominated by work from the USA and is often associated with large organisations which may limit its relevance to both the UK and the small and medium-sized business segments”. In Portugal, SMEs have been almost forgotten by researchers. Lewis and Williams (1986: p.345) expressed this gap by saying that “there is a surprising lack of research on small firms in Portugal, especially given the importance of this sector”.

This research intends to fill a gap in knowledge. It analyses the factors and combinations of factors that enable or inhibit the successful adoption and use of information systems and information technology (IS/IT) in Portuguese manufacturing SMEs. It uses a case study research method, based on a realist perspective of social science (discussed in chapter 4), to analyse and explain the underlying mechanisms and social structures that are likely to determine IS/IT adoption and success.

## **1.2 - Research context**

In the new world economic context, the Portuguese manufacturing industry has a delicate competitive position. The Portuguese industry is dominated by small and medium sized enterprises <sup>1</sup> (98% of the total industrial sector, according to INE <sup>2</sup> statistics). Because of their lack of bargaining power, scarce resources and low management skills, Portuguese SMEs have been deeply affected by the increasing globalisation of the world economy.

The globalisation of the economy allows enterprises to acquire raw-materials, capital and scientific knowledge in international markets, and transfer some activities to other places of the world where labour and capital have a lower cost. The abolition of tariff barriers increases world competition and forces enterprises to improve quality, reduce costs, specialise in new products or develop new markets, in order to improve or sustain their competitive position. In the global economy, it is important to have the ability to quickly deliver a quality product at a competitive price, anywhere in the world. The liberalisation of the socialist block in Eastern Europe and the fast economic development of Asian countries has had a significant impact on Western economies. These countries have lower labour costs and considerable technological expertise. Most Western industries, in particular those in less developed countries, feel the need to look at technology to improve their performance and competitiveness. Pyke (1994) describes the effect of globalisation on small firms in the following terms:

---

<sup>1</sup> According to the Portuguese legislation (*Despacho Normativo 52/87*) a manufacturing SME must have: a) less than 500 employees; b) less than 2 400 000 000 Pt Esc (about £10m, in 1987) annual turnover; and c) cannot be more than 50% owned by any other enterprise that is not below the levels stated in a) and b).

<sup>2</sup> “Instituto Nacional de Estatística” (National Institute of Statistics) - 1991 census.



*Globalization is accentuating competitive pressure on small firms. Small firms with predominantly local markets are increasingly finding themselves in competition with firms from other regions or even other countries. Increasingly, small and medium-sized firms are themselves seeking to invade others' markets. Large corporations are locked in fierce competition on a world stage and this, in turn, has tremendous implications for their small firms suppliers wherever they are located. (Pyke, 1994. p.2)*

In the past, the competitiveness of the Portuguese manufacturing industry was based on the traditional protection of the domestic market and on the assumption that competitive advantage could be sustained through low salaries and low prices of raw materials. As a result of the integration in the European Union, labour costs in Portugal tend to grow (E.I.U., 1995; Pereira and Seabra, 1993) and in the future are unlikely to be a source of competitive advantage, especially when compared with Eastern European and Asian countries. Furthermore, membership of the European Union has reduced protection of the Portuguese industry against international competitors.

In a study of the short-term impact of the European Single Market on Portuguese manufacturing industries, Pereira and Seabra (1993) affirm that the most vulnerable industries are those with high labour intensity and low wages. Since manufacturing wage dispersion in other European Union countries is smaller than in Portugal, with the liberalisation of capital and labour movements in the European Union, lower wages are likely to increase above average (Pereira and Seabra, 1993). On the other hand, for most Portuguese manufacturing enterprises labour costs represent a high percentage of their global costs (Pereira and Seabra, 1993).

According to an in-depth study conducted by Michael Porter (Monitor Co and Porter, 1994), the industries where Portuguese enterprises are more likely to have some competitive advantage are: wine, tourism, automobile components, footwear, clothing, textiles, wood products (including cellulose), mould making, marble, ceramic, and cork. Most of these industries can be classified as manufacturing industries mainly constituted by small and medium-sized enterprises (SMEs). The adoption and use of new technologies and, in particular information technology, is likely to be of crucial importance for the competitiveness of manufacturing SMEs in a global market. Citing Özcan (1995: p.4), when referring to South European SMEs, "new technologies such as the use of informatics in service and production activities have increased small firms' ability to compete and survive in the market".

The development of information systems in the clusters identified by Porter (Monitor Co and Porter, 1994) as internationally more competitive is also recognised as a priority by the academic community in Portugal (Coelho *et al.*, 1995). Because of the fashion characteristics of the products in some of these industries (like clothing and footwear), technological innovations through the use of IT may have a determinant role in increasing firms efficiency and ability to survive in competitive markets. These



technologies support substantially the performance of activities that aim at the continual improvement of the product and, in particular, its design (Rizzoni, 1991).

Looking at previous studies of cross-national culture (França, 1993; Hampden-Turner, 1994; Hofstede, 1980, 1991; Schneider and Meyer, 1991; Schwartz, 1994; and Trompenaars, 1993), the need for research in the Portuguese context is even more evident because there are significant cultural differences between Portugal and the countries where previous research about IS/IT in SMEs was conducted.

In Hofstede's (1980) classical study of cross-national culture, 'Culture Consequences', four dimensions (power distance, individualism/collectivism, masculinity/femininity and uncertainty avoidance) were developed to analyse attitudes amongst a large sample of IBM employees in 40 countries, expanded later with data from ten other countries and three multi-country regions (Hofstede, 1991). Based on Hofstede's (1991) typology of cross-national culture (1991), Portuguese enterprises are more likely to be hierarchical and centralised organisations, reflecting inequality between people at different hierarchical levels, with a relatively autocratic management style and subordinates expecting to be told what to do (*high power distance*). The employer-employee relationship tends to be perceived in moral terms, like a family link, with personal relationships prevailing over tasks (*collectivism*). Compared to most other countries, managers are also more likely to try to solve conflicts by compromise and negotiation, searching for social agreement between social partners before implementing any strategic decisions (*femininity*). Moreover, managers are more likely to fear ambiguous situations and unfamiliar risks, showing some resistance to innovation (*strong uncertainty avoidance*).

Although some criticisms have been made about the composition of the sample (only IBM employees) and the specific period when the data were collected (1968-1973) (Smith, 1994), the external validity of the study is excellent and the results widely accepted by the academic community. According to Søndergaard (1994), 61 replications of Hofstede's study were recorded and the "analysis of the replications showed that the differences predicted by Hofstede's dimensions were largely confirmed" (Søndergaard, 1994: p.451). Furthermore, a recent analysis of the literature in the area of cross-national culture, done by Smith (1994), showed that "there are no indications that the cultural diversity mapped by Hofstede is in a process of disappearing. Recent studies show as much diversity as do those done earlier" (p.14). Franke *et al.* (1991), using samples of 18 and 20 nations for the periods 1965-80 and 1980-87, also found evidence that differences in economic growth can be significantly explained by cultural indices.

National culture is a delicate issue because it has a subtle impact on attitudes and behaviour. In order to analyse accurately the effect of national culture, it is essential to use cross-national studies, comparing similar and representative samples. It is not an aim of this research to test the impact of national culture on IS/IT success factors but to



examine these factors in the light of cultural awareness, being aware that because of national culture some previous research done in other national contexts may not be valid in the Portuguese environment. Studies carried out in Greece produced evidence that national culture has a significant impact on IS/IT planning and use in SMEs (Lyberias *et al.*, 1993 and Doukidis *et al.*, 1994). However, these researchers also concluded that such “cultural factors are likely to manifest themselves in complex, subtle and unexpected ways and should be subject to further research” (Doukidis *et al.*, 1994: p.23).

Portugal has a specific cultural and economic environment that is likely to affect success with the adoption and use of IS/IT in manufacturing SMEs. In a study of small-firms across 73 Portuguese manufacturing industries, Mata (1993) found evidence that some typical SMEs’ characteristics are not recognised in Portugal. For example, Portuguese small firms are less flexible than their large counterparts. Mata (1993: p.120) concludes by saying: “the recognition that small firms may play different roles in different countries is particularly important to avoid importing policy conclusions derived for different contexts”. It is a risk to transfer to enterprises knowledge and experience encapsulated in IS/IT models developed in a different context (Doukidis *et al.*, 1996). In essence, research in SMEs is relatively immature and few theoretical innovations can be found in the recent literature (Reid, 1993). SMEs need their own models that account for their specific characteristics, culture and economic environment.

### **1.3 - Research scope and objectives**

In summary, the relevance of the study is grounded in the new international environment which forces enterprises to change. SMEs, in particular, since they usually have poor resources (Bridge *et al.*, 1998; Welsh and White, 1981) are likely to be less prepared to start the necessary process of change. In order to compete in global markets, many Portuguese manufacturing SMEs need to develop new business and IS/IT strategies. IS/IT is widely recognised in the literature as being able to increase business competitiveness. A better understanding of the ways in which SMEs adopt and implement new technologies, like IS/IT, is seen by researchers as extremely important (Raymond *et al.*, 1996). Previous research in the area is limited, some is out-of-date due to the changing technologies available, concentrated in an Anglo-American cultural context and fails to cover the Portuguese context. In Portugal, there is very little research about SMEs and even less about factors affecting IS/IT adoption and use in manufacturing SMEs, the focus of the research.

The literature review was conducted by looking at three major areas of knowledge and their relationships. These areas are: factors affecting IS/IT adoption and use; characteristics of manufacturing SMEs; and issues related to the Portuguese industry



that are likely to affect IS/IT adoption and use. The research intends to provide a deeper understanding of enablers and inhibitors of IS/IT adoption and success in SMEs. In addition, it extends the existing theory about IS/IT adoption and use in SMEs into a different cultural and economic environment - the Portuguese one.

The Research Context Model (figure 1.1) was used to select the literature and shows graphically the focus of the research (the dark area in the centre) and related areas of knowledge.

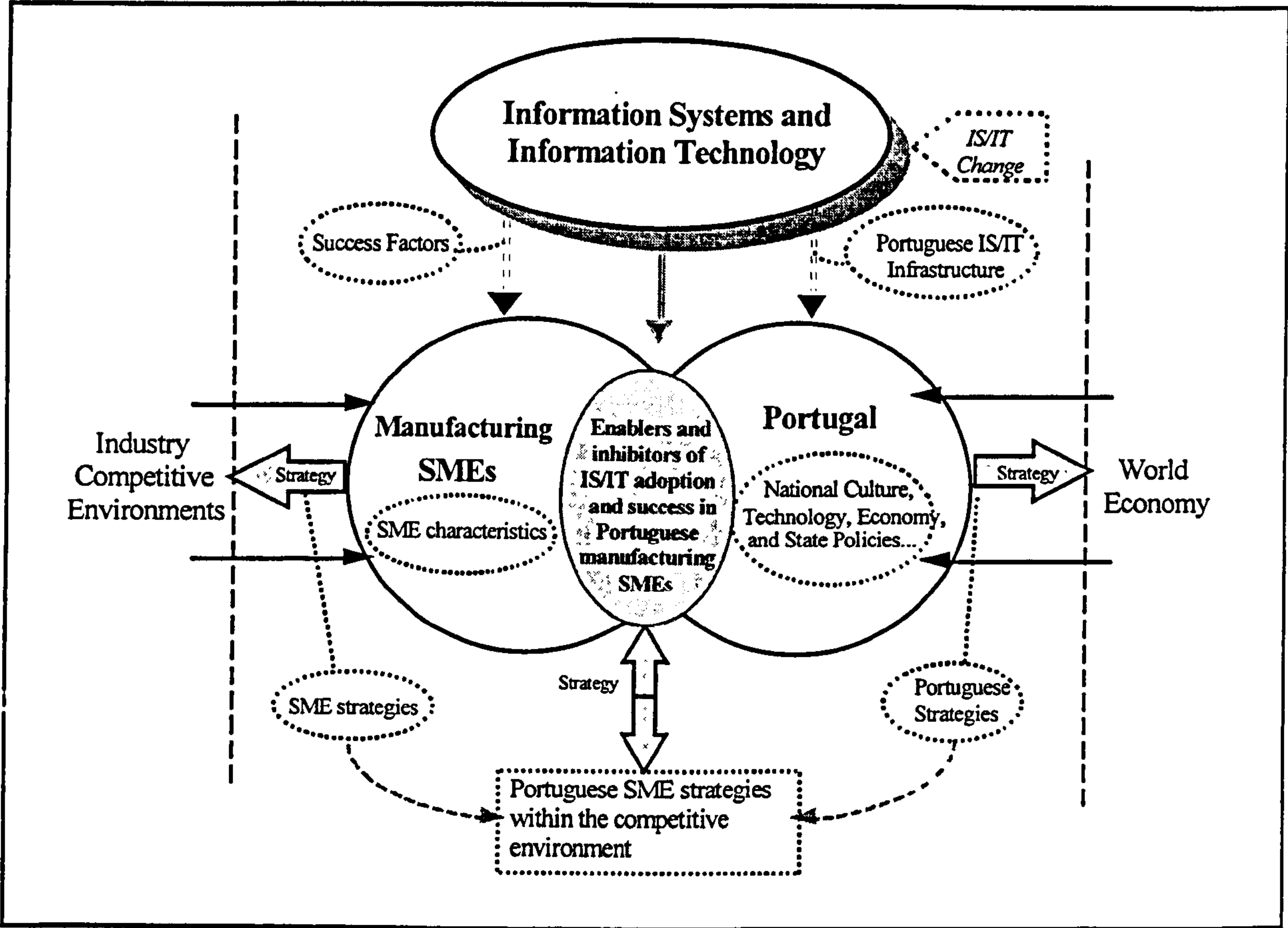


Figure 1.1 – The Research Context Model  
 Source: Compiled by the author

Fast IT change, exhibited in the research context model, is an important variable and increases the need for further studies, because some research done in the past may not be valid now. New IT products are more complex, demand new technical skills, and are likely to have a wider organisational impact.

The aim of this study is to provide a better understanding of IS/IT adoption and use in the Portuguese manufacturing SMEs, by developing a framework that would help to identify, classify, relate and explain the different factors that were identified in the interviews with the key actors (CEO, top managers, IS managers, IS/IT professionals,

key users, IS/IT consultants and IS/IT suppliers) as enablers or inhibitors of IS/IT success in SMEs. Furthermore, the study intends to explain how these factors can be clustered and understand their relationships.

Research in the social sciences with the aim to reach statistical generalisations is usually insufficient to provide a deep understanding of the basic mechanisms that support organisational behaviour. Management science is a social and complex science and most findings obtained by the use of quantitative research are unlikely to explain some of the complex relations that may exist in the subject studied and the different perspectives and interpretations that people involved may have about it. Instead, statistical findings tend to provide basic and general rules, sometimes with little direct practical value to managers. Since different perspectives and interpretations may coexist about the adoption and use of IS/IT in organisations (Walsham, 1993), this study is more oriented to provide ways for understanding and explaining the mechanisms related to the existing problems rather than identifying global generic “solutions”. The research is based on qualitative research methods, by the use of case studies, and on a realist perspective of social enquiry, discussed in chapter 4.

In this research, it is argued that in order to understand the successful adoption and use of IS/IT in manufacturing SMEs, it is necessary to understand the complex relationships amongst a large set of variables and no single factor provides the means by itself to explain IS/IT success. Raymond *et al.* (1996) explain the complexity of the problem:

*It appears difficult, if not impossible, to identify the ‘one best strategy’ to successfully manage technological change in SMEs. This is due to the inherent complexity and heterogeneity of the small business universe, and to the large number of factors that potentially affect the adoption of a new technology, or the progress of a technological development. (Raymond et al., 1996: p.271)*

IS/IT success in manufacturing SMEs is commonly pointed out in the literature as related to a large number of independent factors. Based on a framework developed by Pettigrew *et al.* (1989) to analyse strategic change (see chapter 2), in this research evidence is presented that IS/IT success can be explained by analysing the interaction of factors and sets of factors related to the *context*, *content* and *process* of IS/IT adoption and use.

In summary, the objectives of this research are:

- a) to identify factors that affect the successful adoption and use of IS/IT in Portuguese manufacturing SMEs and to classify those factors according to their relevance in determining IS/IT success;



- b) to explain the mechanisms and social structures that are related to IS/IT success by providing an in-depth understanding of the relationships between the factors and sets of factors identified in a) above;
- c) To develop a framework that enables academics and practitioners to understand the organisational requirements that affect success with IS/IT adoption and use.

Given these objectives, the research questions are the following:

1. What are the factors enabling or inhibiting the successful adoption and use of IS/IT in Portuguese manufacturing SMEs ?
2. How do these factors and sets of factors relate to each other and determine relative success in the adoption and use of IS/IT in Portuguese manufacturing SMEs ?

Two basic temporal stages are inherent to the research. The first stage, *adoption*, refers to factors that are related to the process of IS/IT introduction in the organisation (package acquisition, in-house development, etc.). The second stage, *use*, is related to the factors affecting IS/IT success, when using IS/IT in the organisational processes. In this research, these two stages will be analysed together because in most firms IS/IT adoption and use tends to be a continuous, dynamic and interrelated process.

## **1.4 –Thesis structure**

The thesis is structured in eight chapters. In this **first chapter**, the choice of the research subject was justified and the research objectives were briefly presented.

**Chapter two** discusses the context of the research. It defines important concepts related to the research subject and presents a literature review on factors affecting IS/IT success in SMEs. The literature review is discussed and structured according to the nature of the factors with the aim of developing a research framework to analyse the data collected in the case studies.

**Chapter three** reports the findings from the pilot study that involved several enterprises in the Portuguese clothing and textile industry. This chapter also introduces the research model that was developed from the analysis of previous empirical research and the preliminary fieldwork. This chapter was located in the thesis before the discussion of the research strategy and research design because it is deeply related to chapter 2. The objective of the initial fieldwork is testing and complementing the factors identified in the literature related to IS/IT success and adoption on SMEs in the Portuguese context.

**Chapter four** discusses the philosophical perspective of the researcher, the research strategy and the research design, taking into account the nature of the research topic and the research questions. Alternative philosophical perspectives and research strategies are also presented.

**Chapter five** presents a summary of the case studies and discusses the major issues found in each case. This chapter is relatively large because, for the reader to understand the argument of the thesis, case study summaries have been included in the body of the thesis rather than in an appendix.

The data collected in the case studies is analysed and interpreted in **chapter six**. This analysis is carried out by factor and by cluster of firms. Other clustering alternatives are also evaluated to strengthen the findings. The determinant factors of IS/IT success and adoption are discussed.

**Chapter seven** analyses the findings in the light of the literature on IS/IT in SMEs and some management theories that are becoming frequently used in the IS/IT field: Transaction Cost Theory and Resource-Based Theory. The findings are compared with previous empirical literature on the subject and a resource-based model to explain IS/IT adoption and use in manufacturing SMEs is presented.

Finally, **chapter eight** presents the conclusions, the contribution of the research to the existing body of knowledge, the limitations of the study, and discusses opportunities for further research.



## **Chapter 2**

### **IS/IT success factors in SMEs - A literature review**

#### **2.1 - Introduction**

This chapter discusses the context of the research. Since the focus of the study is on IS/IT adoption and success in Portuguese manufacturing SMEs, it will examine those aspects which can provide a framework for the understanding of the subject.

The concepts of *information systems*, *information technology*, and *small and medium-sized enterprise*, adopted in this study are discussed and defined. The concept of *IS/IT success* is also reviewed from the literature, in order to select appropriate measures to evaluate IS/IT success in the cases studied.

A comprehensive literature review on factors affecting IS/IT success in SMEs is presented with the aim of developing a framework that can be used to analyse the data collected in the case studies. This literature review is structured according to the nature of the factors. The strengths and weaknesses of the existing body of knowledge on IS/IT success factors in SMEs are also discussed.

#### **2.2 - The concept of Information Systems / Information Technology**

The terms *information systems* (IS) and *information technology* (IT) are, nowadays, extensively used across the literature and sometimes with different meanings. These two terms and their related concepts are crucial to this research, therefore it is important to define them and clarify the way in which they will be used in order to avoid any misunderstanding.

As Robert Galliers (1992: p.3) points out, “information systems are a complex topic ... it is a multi-disciplinary and very much a social, rather than a wholly technical, science”. Information systems are a purely organisational concept and must be understood as a system that receives, processes, stores and transmits any form of information. Rivas (1989) states that there is no organisation without an information system. He argues that any business organisation can be interpreted as an information system, simply because it

is a system that manipulates and uses information. According to Rivas (1989), information systems can be seen as a perspective to understand organisational work.

On the other hand, the concept of *information technology* is a technical concept and represents the use of computers and other technological systems to receive, process, store or transmit data. Because the social issues are more abstract and subjective, the fast development of IT and its expanded use tend to obscure the existing differences between the technological concept (IT) and the organisational one (IS). IT is used to automate a part of the formal system of the organisation, where the organisational behaviour is governed by rules (Liebenau and Backhouse, 1990). However, IT introduction usually represents a significant process of organisational change with a consequential impact in the whole organisational system. IT adoption and use are also influenced by management practices, relationships, and involves assumptions, expectations and beliefs about IT benefits.

The concept of *information systems / information technology* (IS/IT), as it will be used in this research, expresses the use of *information technology* to improve *information systems* in organisations. This concept involves the existing theories and methods (social or technical), as well as management issues, related to the utilisation of IT in organisations. This conceptualisation represents the necessary blend between the organisational and technical concepts.

*Information systems* and *information technology* are an important way to develop competitive advantage in organisations (Ciborra, 1994; Earl, 1988; Ward, 1987; Ward and Griffiths, 1996). In several industries, new business opportunities frequently emerge through the use of IS/IT (Benjamin *et al.*, 1984; Porter and Millar, 1985). There are also a large number of examples of IS/IT use by innovative enterprises to gain or maintain competitive advantage, producing evidence of the strategic importance of IS/IT in business organisations (Bergeron and Raymond, 1992; King *et al.*, 1989). Empirical evidence also demonstrates an increasing strategic impact of IS/IT in SMEs (Polland and Hayne, 1998).

### **2.3 - The concept of Small and Medium-sized Enterprise (SME)**

SMEs are predominant in many industries and they have an important role in the economy. Even high technology and capital intensive industries, apparently dominated by large manufacturers, are critically dependent on small firms in their value chain. According to Keats and Bracker (1988), in the USA, 97% of the enterprises can be classified as small businesses. These small businesses employ 58% of the workforce and generated about 87% of the new jobs in the 70s and 80s. Several other authors stress the importance of SMEs in job creation (Birch, 1979; Birley and Westhead, 1990;



Storey, 1994). In Europe the situation is similar. Felstead and Leighton (1992) affirm that at least 98% of the total number of companies in all European Union countries have less than 200 employees. Furthermore, in the last two decades, there has been a considerable increase in the number and relevance of SMEs in Western economies (Sengenberger *et al.*, 1991). In Portugal, the 1991 census identifies and officially classifies 98.2% of the enterprises as SMEs <sup>1</sup>.

In spite of the relevance and frequent use of the term “SME”, there is no generally accepted definition of SME. The definition of SME, used by the academic community, is inconsistent across studies and is strongly influenced by the geographic context of the research. In fact, this definition can be significantly different according to national standards. For example, looking at the variable *size*, which is frequently used for defining *SME*, it is possible to find important differences across countries. While in Greece the official definition of *medium-sized* enterprise is an enterprise employing between 100 and 1000 employees and a *small business* an enterprise with less than 100 employees (Lyberas, 1993: p.6), in Portugal, officially, a SME must have under 500 employees. In other countries the criteria can also be significantly different. In Denmark, a small business is officially an enterprise with less than 50 employees, a medium-sized enterprise must have between 50 and 200 employees, and a large enterprise must employ over 200 people (Barrow, 1993). In France and Germany, a medium-sized enterprise is a firm employing between 50 and 500 people. In Italy, medium-sized enterprises must have between 100 and 499 employees (Burns and Dewhurst, 1986).

It is also interesting to observe the range of designations that proliferate in the academic literature usually referring to the same reality: small firms, small businesses, small and medium-sized enterprises, etc. In terms of number of employees, small firms/businesses may be enterprises with less than: 15 employees (Ibrahim and Goodwin, 1986), 50 employees (Chau, 1994; Cragg and King, 1993; Özcan, 1994; Schleich *et al.*, 1990; Yap *et al.*, 1994); 100 employees (Nazem, 1990; Thong *et al.*, 1996), 200 employees (Abell, 1993), 250 employees (Montazemi, 1987), 300 employees (Delone, 1988) or 500 employees (Lyles *et al.*, 1993; Alpar and Ein-Dor, 1991; Miller and Toulouse, 1986).

In an thorough literature review of small business strategic planning, Robinson and Pearce (1984) discovered that some literature classifies as small businesses enterprises that have up to 2000 employees and annual sales of less than US \$100m (around £62m). Some researchers also refer as medium-sized an enterprise having between 250 and 1400 employees (Hagmann and McCahon, 1993). Furthermore, Keats and Bracker (1988) cite that a list of the 100 most successful small businesses, published by *Business*

---

<sup>1</sup> “Instituto Nacional de Estatística” (National Institute of Statistics) - 1991 census.



*Week* magazine in 1986, defines small businesses as enterprises with annual sales less than US \$150m (around £93m).

Even in the same study, the size of the enterprises classified as small businesses, small firms or SMEs may differ according to the industry where the firm operates. For example, Baker (1987) classifies as small firms, enterprises with 50 to 100 employees in the manufacturing industry and enterprises with 25 to 50 employees in the service sector. In fact, the ratio *number of employees/turnover* varies significantly by type of business or industry. Some traditional industries, like clothing and footwear, are labour intensive industries and the number of employees tends to be relatively high. Other industries are more dependent upon technology and, usually, employ a smaller workforce for similar sales revenue.

The American Small Business Administration generally defines a small business as a firm employing less than 500 employees or annual sales under US \$5m (around £3.2m). In the UK, section 249 of the Companies Act of 1985 states that a medium-sized enterprise must satisfy at least two of the following criteria: a turnover of not more than £11.2 million; a balance sheet total of not more than £5.6 million; and not more than 250 employees (Bridge *et al.*, 1998).

In 1996, the European Commission, with the aim to give SMEs an opportunity to benefit more from Community actions, proposed a general framework for all the measures involved in SME definition. Nowadays, in order to be an SME, an enterprise cannot have more than 250 employees (it was 500 employees before); must have an annual turnover under 40m ECU (around £32.2m) or an annual balance sheet total of under 27m ECU (around £18,2m); and the enterprise should be independent, in the sense that a share of 25% or more cannot be owned by a large enterprise or by a group of large enterprises (Bridge *et al.*, 1998; Kok, 1996; Management Services, 1996).

The European Union definition is not compulsory for the country members. The Portuguese official criteria of SME (determined by the Portuguese legislation - *Despacho Normativo 52/87*) defines an SME as an enterprise that:

- a) has less than 500 employees;
- b) has less than 2,400,000,000 Portuguese *escudos* (around £10m, in 1987) of annual turnover (updated annually);
- c) cannot be more than 50% owned by any enterprise (or set of enterprises) that does not fit in statements a) or b).

Furthermore, politics and national interests may also influence the definition of SME. As a consequence of the importance of SMEs in the economy, governments tend to provide SMEs' financial and economic support and, sometimes, delimit the range of enterprises that could benefit from national policies by manipulating the definition of



SME. Barrow (1993) cites an example of an exceptional case, when in 1966 the American Small Business Administration classified American Motors (an enterprise with 32,000 employees and sales revenue of US \$991 million) as small to enable the company to bid on certain government contracts.

Moreover, it has been argued that other characteristics, rather than the number of employees or sales turnover, can establish a distinction between small and large firms. Definitions based on measures of size like the number of employees, annual sales turnover or profitability, if analysed at a sectorial level, can lead to the fact that in some economic sectors all firms may be classified as small, while in others there may be no small firms (Storey, 1994). In order to overcome this problem the Bolton Committee (Bolton, 1971), formulated an “economic” and a “statistical” definition of small. The “economic definition” proposes the following criteria for small businesses:

- Relatively small share of the market place;
- Managed by owners or part-owners in a personalised way and not through a formalised management structure;
- Not forming part of a large enterprise.

The Committee’s “statistical definition” varies across sectors. For example, it suggests 200 employees or less in manufacturing, 25 employees or less in mining, five vehicles or less for road transport enterprises, etc. These definitions have an inherent problem, they do not match each other and because of that have suffered some severe criticisms. As Storey (1994: p.10) points out, “the Bolton criterion that a small business is ‘managed by its owners or part owners in a personalised way, and not through the medium of a formal management structure’ is almost certainly incompatible with its statistical definition of small manufacturing firms which could have up to 200 employees”. On the other hand, when a firm exceeds 100 employees business owners may start to constitute teams of managers with responsibilities in decision making, and it is unlikely that these firms can be managed in a personalised way, as suggested in the economic definition of small business (Storey, 1994).

In an international seminar for SMEs’ development, the executive director of *The United Nations Centre for Science and Technology for Development* approached the problem of SME definition in the following way:

*The meaning of small and medium enterprises varies from country to country but it is usually based on such criteria as the number of employees, size of initial investment, and turnover rate. A clear definition may be useful in a particular national context but it may not be practical to attempt a universal definition. (Sérgio Trindade, Executive Director of the United Nations Centre for Science and Technology for Development – Trindade, 1987)*



Because there is no general consensus about the definition of small business, small firm or SME, and since it seems that most definitions are strongly oriented by national interests and political reasons and not only real business characteristics, in this research the concept of SME was defined according to the objectives of the study. This research investigates IS/IT adoption and use. Since smaller firms in traditional manufacturing industries are less likely to have significant levels of IS/IT use, the research is more oriented to medium-sized enterprises. In the thesis, the designation "SME" was adopted because the enterprises selected fit in many of the existing definitions of small firms/businesses.

Traditional manufacturing enterprises, operating in sectors such as clothing, textile or footwear, have a dominant role in the Portuguese industry. Because of the historical low wages, many of these enterprises still have more than 250 employees but have similar characteristics to the ones employing fewer people. Since most Portuguese manufacturing industries are labour intensive, the introduction of new information technology is likely to reduce significantly the number of employees and, at the same time, maintain or increase turnover.

Brynjolfsson *et al.* (1994) argue that IS/IT adoption leads to smaller firms and include the number of employees as a variable to measure the size of the firm. These researchers state that: "we find broad evidence that investment in IT is significantly associated with subsequent decreases in the average size of firms. We also find that these decreases in firm size are most pronounced two to three years after the investment is made" (Brynjolfsson *et al.*, 1994: p.1). According to these researchers, this is more visible in the manufacturing sector (in fact, most of the enterprises studied reduced significantly the number of employees in recent years).

Although the new definition provided by the European Commission is likely to be later adopted in Portugal, it is dubious that, nowadays, this definition fits the Portuguese reality. Therefore, in this study firms employing up to 500 employees were selected. On the other hand, very small Portuguese manufacturing firms (for example, with less than 50 employees), in traditional industries (like clothing or footwear) tend to use intensive labour and have very basic computer systems because they do not have much data to process. Most of these firms are subcontracted by one or few larger manufacturers because they are able to provide lower labour costs. As was confirmed in the initial fieldwork, the degree of IS/IT sophistication in these firms is likely to be very low. The firms selected for research generally fit the European Union criteria for an SME, except in the number of employees. In this research, all enterprises studied fit the following criteria:

- a) have between 50 and 500 employees;
- b) have less than £20 million annual turnover;



- c) are independently managed (not controlled by a larger enterprise or group of large enterprises).

Since the definition of the boundaries between small, medium-sized and large enterprises is a complex subject, in this study the terms SME (or small and medium-sized enterprise), small firm and small business are used interchangeably representing firms that are pointed out by researchers as having characteristics significantly different from large enterprises. In a similar way, the terms *entrepreneur*, *business owner* and *CEO* frequently refer to the same person. Nevertheless, “the term *entrepreneur* is commonly used to refer to particular characteristics of ‘innovativeness’ and ‘risk taking’ personalities” (Özcan, 1995: p.3); *business owner* is associated to the person to whom the business legally belongs; and the *CEO* is the person responsible for top management decisions in the firm. In small firms, due to the inherent simple structure that characterises a small business and lack of resources to hire professional managers, the entrepreneur is very often both the owner of the firm and its CEO. In some cases, several entrepreneurs hold a similar capital share and manage the firm in collaboration without any dominant position. In this research, these entrepreneurs will be referred to as *top managers*.

## **2.4 - Concepts and measures of IS/IT success in SMEs**

Information systems success is recognised as a broad concept, and it is not always clear what is expressed by this construct (Weill and Baroudi, 1990). To Brabander and Thiers (1984: p.139) IS success is related to “the final efficiency in the accomplishment of the task for which the information system is to be developed”. From the perspective of a cost/benefit analysis, Ives and Olson (1984) attempted to define information systems success as “the aggregate organisational benefit accruing from it (the computer-based information systems) when compared with alternative investments” (p.591).

However, a cost-benefit analysis approach justifying the purchase and use of computer-based information systems is difficult (Hanes and Ramage, 1977; Ives *et al.*, 1983; Ives and Olson, 1984) and several studies failed to provide evidence that the use of computers improve performance in SMEs (Cragg, 1990; Cron and Sobol, 1983; Turner, 1982; Yap and Walsham, 1986).

Although many studies report that “at least half of all information systems are failures” (Lyytinen and Hirschheim, 1987: p.257), the concept of IS/IT failure is also generally vague and suffers from conceptual weaknesses. According to Lyytinen and Hirschheim (1987) most studies that explore the concept neglect its multi-causal nature. These researchers argue that there are four major categories of IS/IT failure: correspondence failure, process failure, interaction failure and expectation failure. *Correspondence*



*failure* assumes that top management defines in advance IS/IT objectives. If these objectives are not achieved, IS/IT is considered a failure. *Process failure* refers to a situation where IS/IT development cannot produce a workable system or the process produces a system above budget constraints, thus limiting or negating the benefits of that system. It usually shows management inability to allocate the necessary resources to develop IS/IT. *Interaction failure* is based on the level of IS/IT use as a surrogate measure of user satisfaction. It is based on the dubious assumption that if users use the computer system intensively they are satisfied with it. The fourth category, *expectation failure*, occurs when the IS/IT developed does not fulfil the expectations of the stakeholders.

According to Lyytinen and Hirschheim (1987: p.273) the “expectation failure notion appears better” because it is multi-dimensional (technical, economic, psychological, behavioural and political) and can accommodate several problematic situations. However, stakeholders’ expectations may be significantly different and not easy to evaluate with accuracy. As Sauer (1993: p.4) points out, “information systems are seen as an organisational resource which serve some stakeholders but not others”. After a thorough analysis of the literature on the subject, Lyytinen and Hirschheim (1987) argued that any failure analysis is an *interpretive activity* related to understanding IS/IT problems and finding actions to solve them.

*Information systems effectiveness* is also a common expression usually related to IS/IT success (Raymond, 1990). IS effectiveness is frequently defined as “the extent to which an information system actually contributes to achieving organisational goals, i.e. its effect on organisational performance” (Thong *et al.*, 1996: p.252). However, there is a great deal of controversy about the impact of IT in organisational performance. It is generally accepted that the adoption of IS/IT in organisations involves intangible costs difficult to recognise, but the problem is worst when researchers try to evaluate, from a financial point of view, all the benefits of IS/IT. For example, as Ives *et al.* (1983: p.786) say, “some DSS (*Decision Support Systems*) are used for disparate, relatively unstructured, ad hoc decisions; objectively assessing the benefits of such systems may be nearly impossible”. Furthermore, data on systems success, even if possible to evaluate, may not be recorded by the organisation and therefore unavailable for researchers (Ives *et al.*, 1983). Although some case studies provide evidence of significant savings as a result of the IS/IT adoption in organisations (Mukhopadhyay *et al.*, 1995), a precise evaluation of IS/IT effectiveness is a complex if not impossible task.

Eaton and Bawden (1991: p.157) express an essential part of the problem, saying that “the value of information eludes attempts at its precise calculation: it is entirely dependent upon context, use and outcome. Demand analysis techniques are therefore of strictly limited applicability”. Measuring IS/IT effectiveness is a complex task because



it is not easy to evaluate the effect of IS/IT through a large set of linked organisational factors. As DeLone and McLean (1992: p.74) say: “MIS academic researchers have tended to avoid performance measures (except in laboratory studies) because of the difficulty of isolating the effect of the IS effort from other effects which influence organizational performance”. Information as an IS output can be measured at different levels (technical, semantic, and effectiveness) (Delone and McLean, 1992) and through different perspectives (Walsham, 1993). Moreover, few SMEs undertake any formal measure of their IS/IT performance (Evans and Nesary, 1991).

Since it is difficult to evaluate objectively IS/IT success, two independent variables are more commonly used as surrogate measures of IS/IT success in SMEs. Those variables are: level of computer utilisation and user information satisfaction (UIS) (usually CEO’s information satisfaction) (Baroudi *et al.*, 1986; DeLone, 1988; DeLone and McLean, 1992; Montazemi, 1988; Melone, 1990; Raymond, 1985).

DeLone and McLean (1992), through a comprehensive literature review of IS/IT success measures, refer that “in searching for an IS success measure, rather than finding none, there are nearly as many measures as there are studies” (p.61). These researchers developed an integrated view of IS/IT success by defining six major dimensions for IS/IT success: systems quality, information quality, use, user satisfaction, individual impact, and organisational impact (see figure 2.1).

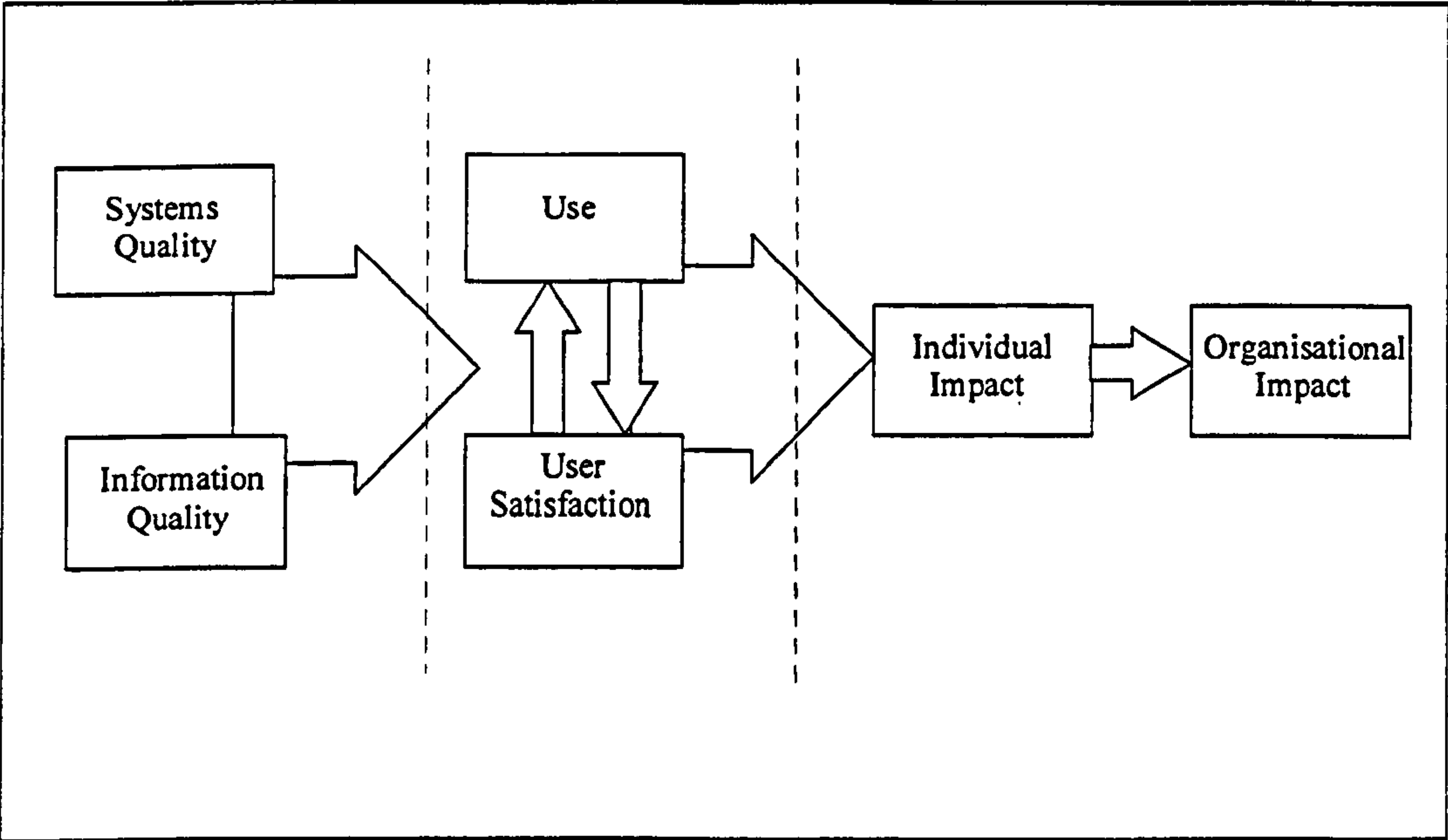


Figure 2.1 - IS/IT success model  
 Source: DeLone and McLean, 1992.

In order to evaluate IS/IT success, some researchers embrace measures of (computer) *systems quality* such as: computer system’s reliability, response time, data accuracy, systems flexibility, and ease of use (Alloway, 1980; Hamilton and Chervany, 1981;



Swanson, 1974). These variables are essentially technical, based on an engineering perspective, and are not likely to be able to faithfully represent managers' perspectives of IS/IT success.

The second measure in the model, *information quality*, is usually viewed by researchers as related to the quality of the IS/IT output (information). The attributes that have been used to evaluate *information quality* are: accuracy, timeliness, reliability, completeness, relevance, currency and precision (Bailey and Pearson, 1983); usability of information (Larcker and Lessing, 1980); or accuracy, timeliness, relevance, aggregation, and formatting (Ahituv, 1980).

The following stage introduces *IS/IT use* as a measure of IS/IT success. However, previous research into IS/IT use in SMEs adopted a different focus. Some researchers analyse CEO use of IS/IT (DeLone, 1988), while others consider the use of IS/IT by firms' accountants (Raymond, 1985). DeLone and McLean (1992) reported that 27 studies employed computer usage or at least one of their associated measures of IS/IT success. According to these researchers, this is because, from the measures presented in the model, systems usage is probably the less subjective, consequently easier to measure.

The perspective that the successful interaction between management and IS/IT can be measured by user information satisfaction is suggested by many researchers (Baroudi *et al.*, 1986; DeLone, 1988; DeLone and McLean, 1992; Ein-Dor and Segev, 1978; Hamilton and Chervany, 1981; Montazemi, 1988; Raymond, 1985), although the question of "whose satisfaction should be measured?" is a pertinent one. Most surveys conducted in SMEs usually measure CEO's information satisfaction (for example, Baroudi *et al.*, 1986; DeLone, 1988; Montazemi, 1988; Raymond, 1985).

According to DeLone and McLean (1992: p.69), "user satisfaction or user information satisfaction is probably the most widely used single measure of IS success". According to DeLone and McLean (1992) this is due to the fact that "satisfaction" has a high degree of "face validity", since it may be hard to classify as not successful a system that users say they like. The usefulness of user information satisfaction is higher when compared to the conceptual weaknesses of most other potential measures of IS/IT success. Furthermore, some instruments have been developed to measure user information satisfaction allowing different studies to be compared (Bailey and Pearson, 1983; Baroudi and Orlikowski, 1988; Ives *et al.*, 1983). However, some criticisms have been made about the usefulness of those instruments to measure user satisfaction (Doll and Torkzadeh, 1988; Malone, 1990; Treacy, 1985).

Raymond (1985: p.38) defines user information satisfaction as "a multidimensional attitude towards various aspects of the MIS such as output quality, man-machine interface, EDP staff and services, and various user constructs such as feelings of



participation and understanding”. A more simple and ample view is provided by Ives *et al.* (1983: p.785) saying that user information satisfaction is “the extent to which users believe the information system available to them meets their information requirements”.

Other measures of IS/IT success, although more rare, can be found in the literature. For example, Cerullo (1980) analyses the individual impact of IS/IT by asking managers to rank the value IS/IT has to them. Finally, IS/IT organisational impact is analysed by researchers as variables like MIS effectiveness or ROI (Return on Investment). The use of these variables generates some discussion because they may be subjective or ambiguous.

The concept of *user information satisfaction* has also generated some controversy (Kim, 1989). In the literature, there are three different, although related, perspectives of user information satisfaction: attitudes towards MIS (Bailey and Pearson, 1983; Ives, Olson and Baroudi, 1983; Miller and Doyle, 1987; Raymond, 1987); information quality (Epstein and King, 1981; Jenkins and Ricketts, 1985; O'Reilly, 1982) and perceived IS effectiveness (Sanders, 1984; Schewe, 1976; Schultz and Slevin, 1975; Welsh, 1986).

To Bailey and Pearson (1983: p.538), user information satisfaction “consists of weighed sum of user’s positive or negative reaction to a set of 39 factors” identified in their questionnaire. However, they declare that for different user environments additional validation efforts are necessary. Baroudi and Orlikowski (1988) developed, analysed and tested a 13-item framework to evaluate user satisfaction but they recommended that:

*...in cases where only a general indication of UIS (user information satisfaction) is desired, with no interest in particular areas of content or discontent, it may be appropriate to employ a single-item measure of user satisfaction as opposed to the relatively quick 13-scale short-form UIS measure. (Baroudi and Orlikowski, 1988: p.55)*

Goodhue (1995) also argues that careful user evaluations are able to accurately reflect the complex interactions between task needs and the technology used in those tasks and provide fairly detailed diagnostics of IS/IT products and services. However, this researcher stresses the need to develop a specific user evaluation construct.

Szajna and Scamell (1993) advocate that one cause of IS/IT failure may be the inability to meet the expectations of its stakeholders (i.e. systems analysts, end users, sponsors and customers). Melone (1990: p.88) argues that “user satisfaction is not sufficient to adequately capture the full meaning of effectiveness”, since it fails to consider the different roles and interests of the users. For example, IS managers and CEOs may have different interests and expectations. While IS managers may be interested in effect, the CEO may be interested in the relation between IS/IT performance and IS/IT investments. According to Melone, the use of user information satisfaction is driven by “the need to evaluate effectiveness and the difficulty of operationalising an economic-



based construct" (Melone, 1990: p.79), but user information satisfaction is not a complete surrogate measure of IS/IT effectiveness.

Although there are different perspectives about the evaluation of organisational performance, Weill and Baroudi (1990), using several variables identified in the literature as performance measures, found significant association between user information satisfaction and firms' performance. Citing Weill and Baroudi (1990: p.21), "UIS (user information satisfaction) is somehow associated with the fundamentally important issues of perceived systems success, position of the user and firm performance".

Since some evidence of a correlation between user information satisfaction and IS/IT success was found in the literature, in this research *user information satisfaction* will be used as a surrogate measure of systems success, based on the general definition suggested by Ives *et al.* (1983: p.785) – user information satisfaction is "the extent to which users believe the information system available to them meets their information requirements". The expression *IS/IT success factors*, used in this research, refers to the factors that were identified in the interviews with the major stakeholders as enablers of inhibitors of IS/IT success, defined by the extent to which the information system available meets managers' information requirements.

Since SMEs are less complex than large organisations, the entrepreneurs and senior managers are usually involved in every organisational process. Therefore, they tend to have a comprehensive perspective of all organisational issues, including IS/IT. Because of that, in the following chapters, user information satisfaction will be used as a synonymous of "management information satisfaction".

It is possible to argue that user information satisfaction is a subjective concept and may be interpreted differently by the different key actors. The purpose of this research is to identify, classify and analyse factors and their interrelationships that may explain what enables or inhibits the successful adoption and use of IS/IT in manufacturing SMEs. In order to achieve this objective, it seems necessary to look at manufacturing SMEs that show different relative levels of satisfaction with IS/IT.

The extent in degree of systems usage as a surrogate measure of IS/IT success will not be considered in this study. Researchers have to be cautious about using systems usage as a surrogate measure of system effectiveness. Baroudi (1986), studying user satisfaction and systems usage, reached the conclusion that usage was dependent upon satisfaction. Srinivasan (1985) argues that in certain types of IS/IT a positive association may exist between systems usage and IS/IT effectiveness, but in other types of IS/IT this relationship may be non-existent. Moreover, due to low IS/IT knowledge and autocratic management style that is likely to be found in Portuguese SMEs (Hofstede, 1980), and the traditional weak position of employees in SMEs (Carson et al., 1995), for



most organisations in this study, systems usage may be not be driven by a “rational” decision and its use is likely to be compulsory. Hence, systems usage would probably be a biased measure of IS/IT success. As Gatian (1994: p.119) points out, “systems usage does not necessarily translate into improved productivity or effectiveness, especially when usage is mandatory”.

## 2.5 - A research framework to study IS/IT adoption and success in SMEs

### 2.5.1 - The initial framework for analysis of IS/IT adoption and success in SMEs.

The framework presented in figure 2.2, described in Pettigrew *et al.* (1989) and in Pettigrew and Whipp (1991), was developed with the aim of understanding strategic change and providing a representation of the mechanisms by which the phenomenon under study operates. This framework has four essential dimensions that, according to the authors, influence strategic change: external context, internal context, process and content.

The *external context* includes the social, economic, business, and political environment that, although external to the firm, influences its behaviour. The *internal context* is composed by the set of resources, competencies, corporate culture, and internal politics that are inherent to the organisation. *Content* refers to the definition of objectives, assumptions, strategic choices, and its evaluation. The *process* includes the set of processes related to defining and implementing business strategy.

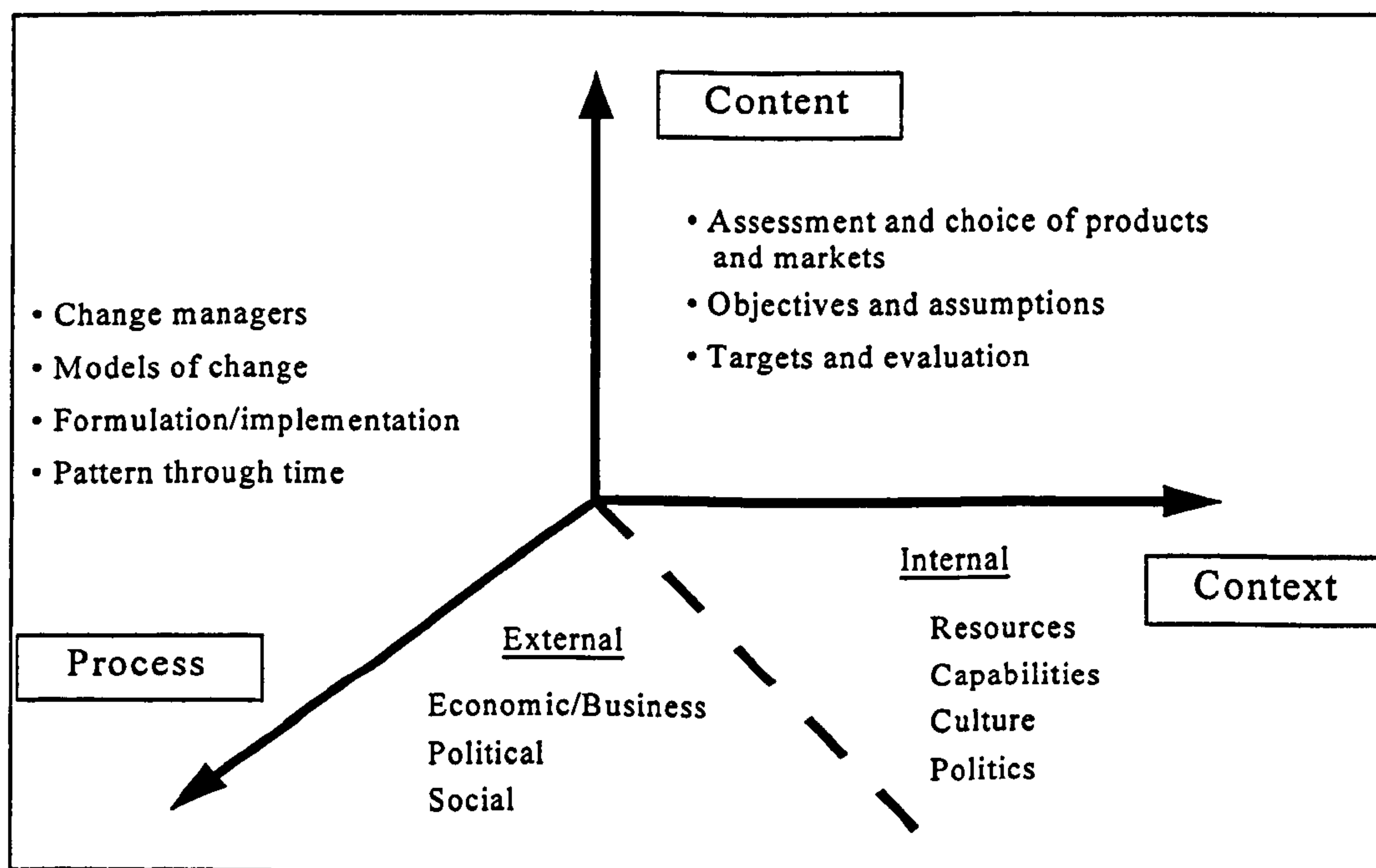


Figure 2.2 - Understanding strategic change: three essential dimensions.  
Source: Pettigrew and Whipp, 1991: p.26.

IS/IT adoption and use is likely to have some similarities with the process of organisational change, hence the use of the framework. Moreover, other research in the field of information systems has also used this framework (see McGolpin, 1996; Walsham, 1993). IS/IT adoption involves a process of organisational change and has a *content*, a *process*, an *external context* and an *internal context* that influence the way it is conducted and its outcome. However, the factors associated with each of these dimensions are specific due to the particular characteristics of each subject. In order to identify those factors related to IS/IT success in SMEs, a comprehensive literature review was conducted.

### 2.5.2 - Summary of the key literature on IS/IT success and adoption in SMEs.

Table 2.1 summarises the most relevant research in the field of IS/IT adoption and use in SMEs. This table includes the reference of the article (for a complete reference, see the list of references included in the end of the thesis), the research place, objectives of the research, research method, measures used to evaluate IS/IT success (or other independent variables adopted in the research), and major findings. The list of references in table 2.1 is structured by date and the most relevant input to this research has the word "*important*" printed below the reference of the article. These findings provide detail to operationalise the initial research framework (figure 2.2) and to develop the final research framework, presented in figure 2.3. However, some of the articles included in table 2.1 were too recent to be used to develop the research framework in 1996. These articles have the remark "*analysed after the fieldwork*".



Table 2.1 - Summary of the literature on IS/IT adoption and success in SMEs

Reference	Research place	Objectives	Research method	Measures	Major findings
Pollard and Hayne (1998) * <i>Analysed after the fieldwork</i>	Canada	Identify new trends related to IS/IT adoption in SMEs.	Survey and telephone interviews.	-	The research reported the following new trends related to the adoption and use of IS/IT in SMEs: improving IS/IT project management practices; building a responsive IS/IT infrastructure; aligning IS/IT within the business; facilitating and managing business process redesign. According to this research small business owners began to see the power of IS/IT and can find the resources to adopt it.
Igbaria <i>et al.</i> (1997) * <i>Analysed after the fieldwork</i>	New Zealand	Explain key factors affecting personal computing acceptance in small firms.	A survey of 358 users in small firms.	System usage	The study tests a structural model examining the hypothesised relationships amongst the following constructs: intraorganisational factors, extraorganisational factors, perceived ease of use, perceived usefulness, and personal computing acceptance (system usage). The findings indicate that perceived ease of use is a dominant factor in explaining perceived usefulness and system usage, and that perceived usefulness has a strong effect on system usage. The results also indicate that exogenous variables influence both perceived ease of use and perceived usefulness, particularly management support and external support. Inconsistent with prior research in large firms, relatively little support was found for the influence of both internal support and internal training.
Yap and Thong (1997a) * <i>Analysed after the fieldwork</i>	Singapore	This paper presents the results of a formal evaluation of the impact of the Small Enterprise Computerisation Programme (SECP) based on the views of various participants.	Survey.	IS/IT success	The main finding is that the government programme has lowered the barriers to computerisation and aided small businesses that lack the resources to computerise successfully and increase organisational learning.
Thong, Yap and Raman (1996)	Singapore	This paper describes an empirical study of the relative importance of top management support and external IS expertise on IS effectiveness.	Survey in 114 small businesses.	IS/IT effectiveness	The results show that top management support is not as important as effective external IS/IT expertise in small business IS/IT implementation. While top management support is essential for IS effectiveness, external IS/IT expertise is even more critical for small businesses operating in an environment of resource poverty.
Raymond <i>et al.</i> (1996)	Canada	Analysing the management of technological change in SMEs.	Case Study analysis in 14 firms. Semi-structured interviews with the entrepreneurs.	-	The research presents an analytical framework for the management of technological change in SMEs. This framework has four main dimensions: technological expertise, decision process, strategic advantage and organisational capabilities. According to the research, there is no one best strategy for technological change for SMEs.
Zinatelli, Cragg, and Cavaye (1996)	New Zealand	Analyse end-user computing sophistication and success in small firms.	8 case studies in manufacturing firms.	User satisfaction	Intra-organisational and extra-organisational factors influence end-user computing (EUC) success. Computer experience, computer training, task structure, education, interest in computers, lack of time, outside work time invested, and availability of quality of EUC tools had a positive influence on EUC sophistication and success. Lack of internal support had a negative influence on EUC sophistication and success. High levels of top management involvement had a positive influence on EUC sophistication. Lack of internal EUC support, lack of external EUC support, lack of new application development, lack of EUC budget plans, used equipment purchases had a negative influence on EUC sophistication. Extra-organisational factors: quality of available external EUC support (positive effect); lack of availability of EUC support (negative effect).



Reference	Res. place	Objectives	Research method	Measures	Major findings
Thong and Yap (1995) * <i>Important</i>	Singapore	Examining the effect of three characteristics of the CEO and three organisational characteristics on IS/IT adoption.	Six hypotheses were formulated and tested using data collected from a sample of 166 small businesses.	IS/IT adoption	The results suggest that notwithstanding the business size and CEOs' characteristics are important factors affecting IS/IT adoption in small businesses. Small businesses are more likely to adopt IS/IT when the CEOs are more innovative, have a positive attitude towards adoption of IT, and possess greater IS/IT knowledge.
Cragg and Zinatelli (1995) * <i>Important</i>	New Zealand	Identify levels of IS sophistication and evolution in SMEs.	Longitudinal study over an 8 year period in 18 small firms.	-	The paper identifies three areas of concern for small firm computing: inadequate hardware and software, lack of internal technical expertise, and insufficient attention by management to IS/IT.
Chau (1994)	Hong Kong	To know how a software package is selected and what factors affect the decision making process.	Questionnaire sent to 500 small manufacturing businesses, with less than 50 employees (68 responses for data analysis).	-	Software characteristics, vendors' capability and opinions/advisers given by other concerned parties are important factors considered by owners/managers. Managers with a higher level of computer literacy tend to emphasise technical factors. Managers used to packaged software give more importance to the competence of the vendor. Owners tend to look at technical factors, while managers tend to emphasise more non-technical factors (price and popularity of the software package).
Lai (1994)	USA	To analyse to impact of computer use on decision performance. The survey also tested the relationship between organisational characteristics and success of computer use.	Survey. 500 small businesses.	User satisfaction and the extent of computer use.	Executives were satisfied with their computer systems, however many did not perceive a positive correlation between computer use and cost efficiency, they did not perceive the computer as a strategic tool for the business. The survey showed that IS/IT ranking function, age of business, and IS/IT experience were significantly associated with success of computer use.
Naylor and Williams (1994) * <i>important</i>	UK	Identification of factors that may contribute to the successful use of IS/IT in SMEs.	Case studies in 30 firms using IS/IT, with less than 200 staff and below 10 million pounds of annual turnover.	User satisfaction	Most companies were well informed in IS/IT matters and showed little evidence of resource poverty. However, there was lack of formalisation in IS/IT strategy. 1/3 of the sample realised the value of IT as a strategic weapon. Four companies used IS/IT to develop new markets. Seven companies had gone behind elementary software applications: look for secondary benefits, use IS to develop new products, and incorporate IS/IT in future business plans. The successful use of IT in SME depends on the skill of the managers to interact with IS.
Cragg and King (1993) * <i>important</i>	New Zealand	To examine the evolution of small-firm computing.	Longitudinal study in 6 firms with less than 50 employees.	IS/IT growth applications, number of users, diffusion of IS/IT, and managerial IS/IT practices.	Application growth tends to take place in firms where the owner was enthusiastic towards IS/IT. The strongest inhibiting factors of IS/IT growth were: lack of IS/IT knowledge, lack of managerial time, poor consultant support and limited financial resources. The firms studied demonstrated low levels of internal IS/IT expertise and poor relationships with IS/IT specialists. They also showed little desire for this situation to change.
Chen and Williams (1993)	UK	To know the level of microcomputer use 10 years after its effective introduction.	Postal questionnaires followed by interviews. 216 companies with less than 50 employees.	-	Microcomputers are primarily used for basic and operational purposes rather than for decision making purposes.
Cragg and King (1992)		The study investigates the relationship between IS/IT sophistication and financial performance.	Survey. 289 engineering firms.	-	It was found that firms with more sophisticated IS/IT performed no better than firms with no or less sophisticated IS/IT.
Yap, Soh, and Raman (1992) * <i>Important</i>	Singapore	Reports an empirical study of key factors associated with IS/IT success in small businesses. <i>Development of a descriptive model with the key factors.</i>	Questionnaire survey addressed to 282 SMEs.	User information satisfaction.	IS/IT success is positively associated with consultant effectiveness, level of vendor support, length of small business's IS/IT experience, sufficiency of financial resources, level of CEO support, and level of user participation. CBIS success is not associated with the number of administrative applications nor the presence of a computer programmer or systems analyst.



Reference	Res. place	Objectives	Research method	Measures	Major findings
Gable (1991)	Singapore	This paper is an exploration of the consultant engagement process in small businesses selecting a computer.	Case Study research.	-	Because of their limited number of senior positions and fewer alternative career paths, small businesses have a more difficult time attracting and retaining skilled IS/IT staff and are thus dependent upon external expertise. Small businesses are particularly dependent on outside expertise when first computerising. Because small businesses suffer from severe financial constraints, it is often difficult to justify the cost of custom software. Small businesses often overestimate the impact of consultant and vendor support in achieving successful computer systems selection and implementation.
Alpar and Ein-Dor (1991)	USA	To identify major IS issues of concern to IS managers and top management.	Quantitative analysis. 526 respondents. 99% of the firms had less than 500 employees (US small business administration criterion for small business).	-	Computer firms are more concerned about cost and development. Non-computer firms are more concerned about systems quality and control. Running the business was the major reason for computer use (the 2nd was decision-making, and the 3rd strategic advantage). No correlation was found between issues of concern to IS managers and top management and the following variables: number of years of computer use, IS planning, data processing costs, hardware costs and amount of software developed in-house.
Raymond (1990)	Canada	This paper proposes a contingency approach relating selected organisational factors, namely organisational size, maturity, resources, time frame, and IS sophistication to user satisfaction and system usage.	Structured interviews with CEO, financial manager and production manager.	User satisfaction, system usage, and IS/IT sophistication.	The level of IS success and the level of IS/IT sophistication are positively related to: larger size of the organisation, the level of organisational maturity, the number organisational resources allocated to IS/IT; the longer the organisational time frame. It was found that the higher the level of IS/IT sophistication, the higher the level of IS/IT success.
Kagan, Lau and Nussgart (1990)	USA	To investigate the adoption of IS/IT by SMEs. Analyses: differences relative to IS/IT usage; impact of the firm size in the level of software sophistication; hardware capacity and remote processing capacity; the relationship between software sophistication and software sophistication; nature of IS/IT applications.	Quantitative analysis. 884 small business firms (less than US \$5m and less than 250 employees).	-	The manufacturing sector has the largest proportion of firms that write their own software applications. Small business use of IS/IT is unique to each small business sector. The intensity of computing varies among sectors and firms. SMEs and large enterprises have different computer needs. As a small firm develops in size, its information needs will increase in level of sophistication. As the level of IS/IT application sophistication increases, the managerial span of control of the small business manager should decrease, implying that IS/IT is being tailored to more strategic and tactical applications.
Nazem (1990)	USA	Investigate how small businesses were coping with the process of computerisation of their business performances.	Quantitative analysis. Survey in SMEs with less than 100 people.	IS/IT satisfaction	SMEs obtain their application software from different sources. The major source of software was found to be off-the-shelf standard programs. Small businesses are also generally satisfied with off-the-shelf packages software, despite of the apparent lack of vendor support service and training facilities.
Schleich, Corney, and Boe (1990)	USA	Identify problems with the use of microcomputers in small businesses.	Survey in small businesses with less than 50 employees and annual sales of less than US \$20m.	-	Problems with IS/IT: inadequate hardware selection procedures; inadequate software selection procedures; poor systems planning; poor external support; unsatisfactory levels of knowledge and training.



Reference	Res. place	Objectives	Research method	Measures	Major findings
Raymond (1989) * <i>Important</i>	Canada	Examine the status and the factors related to the level of success of MIS in small businesses.	Quantitative analysis. 34 small manufacturing firms. Structured interviews to financial and production managers.	-	The management of the organisation's information resources is not the heart of the preoccupation of small business managers. The initial computerisation of the SME is too often done in an almost total empirical manner. The majority of the firms: do not plan or control formally their computerisation process; do not identify problems and opportunities prior to the needs analysis; conceptualise their needs in terms of a computer system rather than in terms of an IS; do not have formal documentation; have insufficient preparation and training of the users.
Martin (1989)	UK	Identify and explore the special role of the small business top manager in the development of IS/IT in his business.	Semi-structured questionnaire sent to top managers of 16 manufacturing & distribution firms (5 to 200 employees).	-	Most managers have little computer training. The level of involvement of the top manager is dependent on organisational resources, and indirectly on organisational size.
DeLone (1988) * <i>Important</i>	USA	Investigate the factors that affect the successful use of IS/IT by small businesses.	Survey. 93 manufacturing firms, with fewer than 300 employees, and less than 30m USD in annual sales revenues.	Management IS/IT usage. Impact of IS/IT in firm's profits, return on IS/IT investment, and effect of IS/IT on cash-flow.	IS/IT success is associated with: CEO knowledge and involvement in computer operations; the use of on-site computers. Factors not associated with IS/IT success: the use of external programming; employee acceptance of computers; length of computer use; the level of computer training for employees.
Montazami (1988) * <i>Important</i>	Canada	Find what is the relationship that exists between organisational characteristics and end-user satisfaction associated with IS/IT in small businesses.	Qualitative and quantitative analysis (semi-structured questionnaire and interviews). 47 service and 36 manufacturing firms.	User satisfaction.	End-user satisfaction in SMEs is positively associated with: the presence of a systems analyst, information requirements analysis, the involvement of the user in IS/IT development; user computer literacy; interactive applications, less centralised organisations. End-user satisfaction in SMEs is not associated with special purpose applications and duration of IS/IT experience.
Raymond (1988) * <i>Important</i>	Canada	Study the importance of computer training and education in the attitudes of SME managers through computers.	Quantitative analysis. Sample of 34 SMEs in the manufacturing sector.	Information satisfaction, level of on-line usage.	Information satisfaction, level of on-line usage and diversity of application do not seem to be related to prior computer experience. Computer training and education have an important positive effect upon the attitudes and computer usage behaviour of small business managers. Education and training appears to promote positive attitudes and use, more effectively than does organisational experience with computers.
Lefebvre and Lefebvre (1988)	Canada	Determine the expectations and perceptions of managers of SMEs with regard to IS/IT use and impact in the organisation.	Quantitative analysis. 44 firms with less than 100 employees.	-	In most firms computerisation was a manager's idea. Investments in IS/IT were about 3% of firm's sales. 80% of the firms had no master plan and did not do any cost-benefit evaluation.
Baker (1987)	USA	Understand the current status of information management in SMEs.	Quantitative analysis. Small firms in manufacturing and service. On-site interviews with the CEO or his designate.	-	General recommendations: more computer training for the CEO and other top managers; more attention on implementation of compatible and integrated systems; formal appointment of a top-ranking person to serve as "Chief Information Officer".
Lincoln and Warberg (1987)	USA	Know what is the level of microcomputer utilisation in small businesses.	Quantitative analysis. 303 questionnaires sent (10% returned).	-	Small business microcomputers appear to be predominantly used for transaction processing.



Reference	Res. place	Objectives	Research method	Measures	Major findings
Lees (1987)	USA	To investigate the characteristics of IS/IT in small businesses.	Quantitative Analysis. 400 members of the chamber of commerce.	IS/IT satisfaction and usage.	Small business IS/IT satisfaction and usage will be greater in organisations that: do formal systems analysis and design (and consider future business needs in systems analysis and design); involve users in systems analysis (how they are involved is also important); have a good vendors relationship; have used computers for a long period of time; have decision makers with IS/IT experience; are larger (positively associated with computer usage but not with IS/IT satisfaction); operate in a benevolent external environment (positively associated with IS/IT satisfaction but not with computer usage).
Lees and Lees (1987)	USA	Identify the current situation of small businesses' IS/IT implementation.	Quantitative analysis. A questionnaire sent to 400 decision-makers.	IS/IT satisfaction and usage.	Most frequent reasons to implement micro-computer systems: to improve operational procedures (71%); to reduce cost (42%); availability of new management tools (40%); to facilitate business/organisational growth (35%). The survey revealed that small businesses often: possessed inflated expectations of the benefits to be achieved from IS/IT implementation; underestimated the time, effort and expense involved with IS/IT development & implementation; overestimated the impact of hired consultants and vendor's support in achieving successful implementation.
Montazemi (1987)	Canada	Examine the environment of IS/IT in small business firms.	Structured questionnaire sent to 242 firm with less than 250 employees in service and manufacturing. Data collected from 83 firms.	-	A negative relation was found between age and computer experience. Only 19% of the firms had access to a systems analyst. Deficient IS analysis. The educational background of the DP personnel was related to the organisational complexity of the firms. No long range planning or policy for hardware acquisition. None of the SMEs had a specific policy for software development. Positive correlation between end-user computer literacy and end-user participation in information requirement analysis.
Nickell and Seado (1986)	USA	Investigate the attitudes of small business owners/managers towards IS/IT and how computers are used in small businesses.	Quantitative analysis. Survey in firms with more than 1500 employees were excluded.	-	The specific computer applications used by small business managers are different from the ones used by managers of larger businesses. The experience with computers has an effect on attitudes towards computers.
Irish Management Institute (1985)	Denmark, Greece and Ireland	Managers were asked to describe the major problems that resulted from introduction of the microcomputer into the company.	Survey in small businesses that employ about 100 or less staff.	-	A correlation was found between lack of previous experience with computers and the occurrence of major problems with the introduction of microcomputers into the firm. Problems were due to: lack of previous company experience with computers; little personal experience with computers; low utilisation of external objective sources of professional advice; lack of training in relation to computer feasibility studies, equipment and systems selection and planning for implementation.
Raymond (1985)	Canada	Analyse the organisational characteristics of computer usage which are associated with the success of IS/IT in the small business.	Questionnaire sent to the finance manager. Quantitative analysis of manufacturing SME, having between 20 and 250 employees.	IS/IT satisfaction and computer usage.	Negative correlation between IS/IT experience and user satisfaction. Users are slightly more satisfied in firms who developed a greater proportion of their applications internally. IS/IT success is positively associated with: in-house processing, greater number of administrative applications, on-line applications (managers prefer an interactive system), a MIS function situated at a high international level. No regional differences were found in terms of user satisfaction or systems utilisation. Firms located in more remote regions had more problems attracting competent IS/IT staff or obtaining support.
Ein-Dor (1978)	-	A conceptual schema, developed from the literature, with factors that are likely to affect IS/IT success.	-	IS/IT use.	Organisational variables affecting IS/IT success or failure: size of the organisation; structure of the organisation; organisational time frame; extra-organisational situations (such as availability of IS/IT); resources (budgeting); organisational maturity; psychological climate; rank and location of the executive responsible for MIS; steering committee (to develop IS/IT in the organisation).



### 2.5.3 - The research framework

This research analyses the relationship between factors related to the context, content and process of IS/IT adoption and use, and tries to understand how these factors interact and interdependently determine relative success with the adoption and use of IS/IT in manufacturing SMEs. In this chapter the initial framework for analysis was used to structure the factors found in previous empirical research and review other relevant literature. These factors were mapped across four dimensions according to their primary<sup>1</sup> nature (internal context, external context, process and content), using a framework adapted from the work of Pettigrew *et al.* (1989) (see figure 2.3).

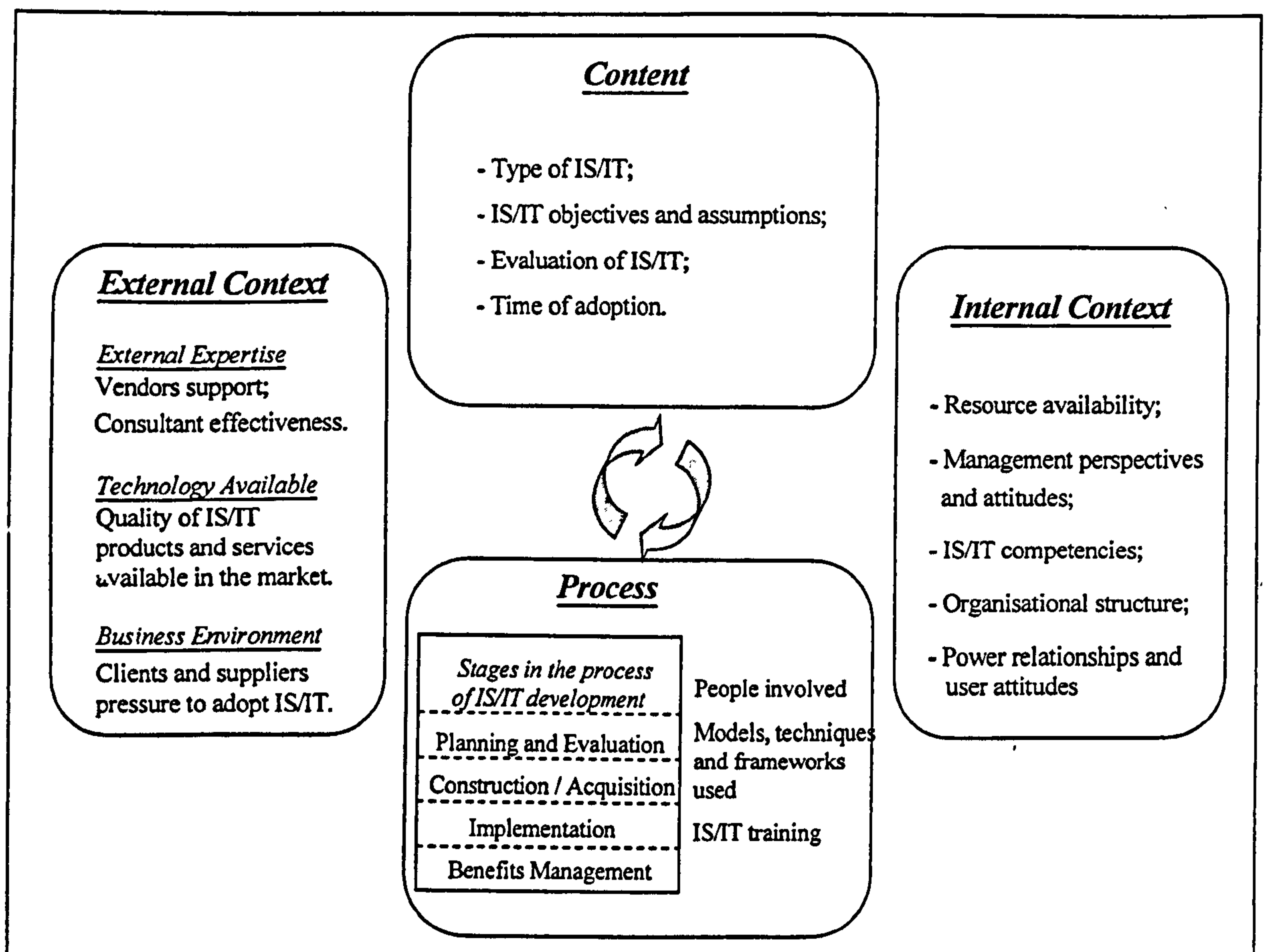


Figure 2.3 - The initial framework for analysis of IS/IT in SMEs

Source: Compiled by the author, based on Pettigrew and Whipp (1991)

<sup>1</sup> The adjective "primary" was used because these factors may be classified in more than one dimension.



## **2.6 - Factors related to the *Internal Context***

### **2.6.1 - Resource Availability**

Small firms, when compared with large enterprises, usually have a simpler structure with less specialised tasks (Carson *et al.*, 1995; Mintzberg, 1979) and poor human, financial and material resources (Kaye, 1990; Welsh and White, 1981). Since they are likely to have less resources and less ambitious objectives, SMEs tend to have more limited computer systems. Furthermore, because SMEs are financially weak, IS/IT investments may be often classified as financially significant and having an important impact on the organisation. On the other hand, IS/IT failure may have a strong negative impact on a business heavily dependent on it (Thong, 1996).

SMEs usually suffer from cash-flow problems, do not evaluate rigorously their current financial position and have difficulty in getting financial loans (Welsh and White, 1981). The importance of available financial resources was identified by Cragg and King (1993), using longitudinal studies in SMEs, as a strong inhibitor of IS/IT development. The limited access to financial resources also restricts software and hardware expenses and the quality of available external and internal expertise (Heikkila *et al.*, 1991).

Although SMEs have low financial resources and difficulties in generating cash-flow, few measures are designed to evaluate the cost and effectiveness of IT in the organisation (Raymond and Paré, 1992). In a research conducted in Singapore, Yap *et al.* (1992) found a strong correlation between organisational factors and CBIS (computer-based information systems) success.

In the literature, lack of qualified human resources is pointed out as a problem for many SMEs (Blili and Raymond, 1993; Raymond *et al.*, 1990). However, the literature also provides contrasting evidence. For example, Naylor and Williams (1994), studying the successful use of IS/IT in SMEs, found little evidence of resource poverty restraining the development of IS/IT.

### **2.6.2 - Management perspectives and attitudes towards IS/IT adoption and use**

Some SMEs' characteristics, identified in the literature, are likely to explain top management perspectives and attitudes towards IS/IT adoption and use. This section explores some of these characteristics that appear relevant to understand IS/IT adoption and use. These include: strategic planning and managerial techniques; the role of the CEO; management expertise; attitudes towards innovation; and attitudes towards IS/IT adoption and use.



### 2.6.2.1 - Managerial techniques and strategic planning

The literature explains that, in SMEs, the management decision process is considered to be more intuitive and less formal than in large enterprises (Rice and Hamilton, 1979). SMEs are characterised by a low level of organisational maturity and usually place little emphasis on formal strategic planning (Baker *et al.*, 1993; Raymond *et al.*, 1990; Sexton and Van Auken, 1985). Chen and Hambrick (1995) found that small firms tend to be more active than large enterprises in initiating their competitive moves but large enterprises tend to be more responsive when threatened by competitors. According to Rice and Hamilton (1979), the planning behaviour of SMEs can be characterised as vague and inadequately defined, generally pragmatic and short-range oriented.

Although there is some evidence that structured strategic planning is positively correlated to firms' financial performance (Bracker *et al.*, 1988) and formal strategic planning is likely to improve competitive advantage (Lyles *et al.*, 1993), most surveys about strategic planning in SMEs report that SMEs do not perform true strategic planning, only sporadically or temporarily (Sexton and Van Auken, 1985). However, previous research shows that management may have a strong effect in IS/IT evolution and sophistication, since most of the inhibiting factors found are internal rather than external to the organisation (Cragg and Zinatelli, 1995).

Through an in-depth analysis of previous empirical research on small firms' strategic planning, Robinson and Pearce (1984) concluded that the major reasons for the existing lack of strategic planning in SMEs were: managers' lack of time to concentrate in strategic planning, since they are permanently involved in solving daily operational problems; managers' low management knowledge about the process of strategic planning; the typical character generalist of the small business manager, with lack of specialised expertise; and managers' lack of trust and openness to share their strategic plans with employees or outside consultants.

However, some researchers also argue that the dynamics of today's markets do not allow truly strategic planning, and that strategy absence should be seen as a legitimate phenomenon that should be considered and studied (Inkpen and Choudhury, 1995; Mintzberg, 1994). Furthermore, it is argued that previous academic work of strategic management was seeking strategy where, sometimes, there was none. In many cases, small business planning tends to be only a mental activity of the owner/manager who frequently relies on advice from people with even less skills and experience than himself/herself (Robinson, 1982). Solomon and Fernald (1993) also found that most small business managers prefer face-to-face sources of information over impersonal sources of information.



Chell and Haworth (1992), conducting case study research in the clothing industry, noticed that many small business owners tend to spend too much time on operational decisions and insufficient time on the development of a competitive strategy. Bracker and Pearson (1986) argue that the involvement of an SME in formal strategic planning is directly related to its age. According to these researchers, younger firms tend to spend more time developing their formal strategies while older firms give more importance to daily operations.

In spite of the current use of financial measures to evaluate firms' performance, some researchers argue that it is not the time spent in planning itself that affects economic performance but the quality of planning (Burt, 1978; Orpen, 1985). Others accentuate that financial performance is only one element of organisational performance and "non-financial benefits are the real output of the planning system" (Kiernan and Morris, 1994: p.35).

A more radical perspective can be found in the *Evolutionist*<sup>2</sup> point of view that, nowadays, the environment is rapidly changing and is typically too complex and unpredictable to be effectively anticipated. Whittington (1993: p.3) details this approach by stating that "the dynamic, hostile and competitive nature of markets means not only that long term survival cannot be planned for; it also ensures that only those firms that somehow do hit upon profit-maximising strategies will survive".

Mintzberg (1994) emphasises the role of imagination and creativity in strategic thinking and questions the importance of formal strategic planning by suggesting that "managers don't always need to program their strategies formally. Sometimes they must leave their strategies flexible, as broad visions, to adapt to a changing environment" (Mintzberg, 1994: p.112)

#### **2.6.2.2 - The dominant role of the CEO**

The literature stresses the importance of CEO support in IS/IT adoption and use (Bruwer, 1984; DeLone, 1983; Yap *et al.*, 1992; Yap. *et al.*, 1994). It is generally accepted by small business researchers that SMEs are strongly characterised by the dominant role of the CEO (usually the entrepreneur and owner) and influenced by his personality and ambitions (Birley, 1982; Carrier, 1991; Deeks, 1976; Ibrahim and Goodwin, 1986; Kotey and Meredith, 1997; Miller *et al.*, 1982; Özcan, 1995).

Since most SMEs have a flat organisational structure, the CEO tends to concentrate decision-making in his own hands. The CEO has the authority to influence other members of the business and is likely to succeed in overcoming any organisational

---

<sup>2</sup> The term "Evolutionary" is used by Whittington (1993) to classify this approach.



resistance to accept IS/IT (Markus, 1983; Thong, 1996). He is the main factor in the firm's success or survival and his management ability is extremely important in developing firm's characteristics and competencies (Wingham and Kelmar, 1992). The dependency on one person provides the means for a more effective and flexible organisation, but it is also a risk compared with more collective processes of decision making (Doukidis *et al.*, 1996; De Geus, 1988). Furthermore, this risk may be higher due to the lack of management expertise that it is likely to be found in small business owners. Miller and Toulouse (1986) found out that, independent of the enterprise size, delegation of authority was highly correlated with business success.

Thong and Yap (1995) found that CEOs' characteristics are important factors affecting IS/IT adoption in SMEs. SMEs are more likely to adopt IS/IT when the CEOs are more innovative, have a positive attitude towards IS/IT adoption, and possess higher levels of IS/IT knowledge. The entrepreneur (CEO, owner) concentrates the power to decide about the implementation of IS/IT for strategic or competitive purposes.

Lin *et al.* (1993) emphasise the role of the CEO in IS/IT adoption and use by saying that:

*...at the heart of most IT problems are 'people' problems. The performance of the IT is not a matter of responsiveness and quality of commitment at all levels of the organisation ... Small business executives should focus on ownership and sharing of knowledge to implement strategic initiatives and contribute to them. (Lin et al., 1993: p.28)*

Keats and Bracker (1988) developed a model of small firms' performance based on several characteristics of the owner: the degree of entrepreneurship, his/her level of task motivation, and the degree to which the individuals perceive that he/she has the ability to influence critical elements of the operating environment. Smith (1967) and Smith and Miner (1983) designed a typology to analyse the entrepreneurial character. The key types are: the *craftsman entrepreneur*, motivated by the pleasure in doing what they like, meeting their personal and family needs and in avoiding working for others and the *opportunistic* type, driven by the desire to build a firm and achieve economic gains. Lafuente and Salas (1989) extended this typology, defining four "ideal types" of entrepreneurs (craftsman, risk-oriented, family-oriented, and managerial entrepreneurs) which will influence the type of firm being created and the management style being adopted.

Lefebvre *et al.* (1997) state that CEOs' perceptions of the external environment are key significant issues with respect to technology policy formulation in SMEs. In the initial fieldwork, described in chapter 3, IS/IT failure is frequently perceived or referred to, by the CEOs, as related to the external context (like the low quality of software available in the market or low vendor's support). This is consistent with previous management research that, based on an analysis of managers' attributions for good and poor



performance in the annual reports, drew the conclusion that “good performance is generally attributed to management actions while poor performance is often attributed to external factors” (Clapham and Schwenk, 1991: p.220).

### 2.6.2.3 - Management expertise

In the literature, management expertise is usually mentioned as a weakness of SMEs. In contrast to large enterprises, small businesses may face similar problems and decisions, but they are likely to have lower management expertise (Raymond and Magnenat-Thalmann, 1987). According to a study conducted by the American Small Business Administration, 90% of SMEs fail due to lack of management ability (Gordon and Key, 1987). Moreover, inefficiencies are less tolerated by small firms and growing firms than by established larger organisations (Dandridge, 1979). Welsh and White (1981) argue that small firms can hardly survive mistakes or misjudgements and loss of liquidity is a major fear:

*A small business can survive a surprisingly long time without a profit. It fails on the day it can't meet a critical payment. In a small company, the cash-flow is more important than the magnitude of the profit or the ROI. (Welsh and White, 1981: p.29)*

Small firms are unable to afford much of the professional services that are available to large organisations. Therefore, SME managers need to have a short range management perspective with a more generalist type of thinking because they are required to solve problems in many different areas (Welsh and White, 1981). According to Wynarczyk *et al.* (1993), there are three important distinctions between small and large firms. First, small firms have a greater external uncertainty of the environment where the firm operates. Second, although small firms are less likely to undertake research and development of new products, they are more likely to introduce fundamental innovations because small firms are less committed to the existing practices and products. Third, in small firms the probability of a process of change and evolution to occur is higher than in large corporations.

Edmunds (1979) argues that management in any size of SME is more efficient and competent than in large firms. Instead of economies of scale, large enterprises frequently get diseconomies of scale. Edmunds' argument is anchored on the fact that, in the USA, small businesses pay relatively more taxes than large businesses. Furthermore, an analysis of Dun & Bradstreet's databases, undertaken by Ducan and Handler (1994), reveals that most small businesses do not fail in their first years as it is suggested by the literature. Statistics about small business sometimes show high failure rates because they include “firms” that are not serious business activities, but rather individuals selling their labour as well as “casual firms” that for various reasons were “discontinued” (for example, reaching the ultimate objective of the firm). In fact, one of the major problems with research on SME's success and failure is the lack of suitable



and reliable data (Scott and Lewis, 1984; Cochran, 1981). As Cochran (1981: p.50) suggests, "like the weather, small business failure is the subject of much discussion...but unlike the weather... there is ... a dearth of timely, reliable, and relevant information on small business failure rates". Failure rates may vary substantially depending on the definition of failure that is used (Ducan and Handler, 1994; Watson and Everett, 1993).

Doukidis *et al.* (1996: p.192) state that "the introduction of information technology, which may lead to dramatic changes in the business fundamental activities, requires an awareness and basic knowledge within the management function". From a study of small business success involving 30 manufacturing SMEs with less than 200 employees, Steiner and Solem (1988) concluded that success is positively associated with managerial experience and the ability of a firm to adapt its operations to changes in markets, products, raw materials, labour costs, labour availability, and technology. In the view of these researchers, successful firms tend to change their technology more often than unsuccessful firms, and the failure to adopt new technologies may be associated to financial constraints.

Although information technology is nowadays much cheaper than before, it may represent a significant investment for many SMEs, that traditionally have a lack of financial resources. On the other hand, there is an increasing offer of more sophisticated information products and services that SMEs may adopt to improve their performance.

#### **2.6.2.4 - Attitudes towards innovation**

In a comparative study of *intrapreneurship* in large firms and SMEs, Carrier (1994) found that SMEs differ from large firms in several ways and that SMEs are often perceived as far more productive than larger firms in terms of innovation. Managers in large organisations tend to give more importance to efficiency and stability and may sometimes feel threatened by the possibility of an unexpected contribution by an employee. SMEs usually have a friendlier environment, with more simple structures and decision processes, and employees have easier access to the top management. Some researchers argue that control systems in large enterprises frequently become an obstacle to innovation (Hill, 1987). A study of small firms' performance, conducted by Miller and Toulouse (1986), concluded that large firms appear to benefit less from strategies of innovation. However, other researchers argue that large firms tend to adopt innovations before smaller ones do (Attewell, 1992).

Rizzoni (1991) proposes an interesting taxonomy to describe technological innovation in small firms. Six different types of small firms were identified: static, traditional, dominated, imitative, technology-based and new technology-based. *Static firms* show some conservatism and inefficiency and are not seen as innovative. These firms operate in low labour cost industries and their market is restricted to traditional products based



on a rather simple technology. The entrepreneur has a dominant role. As Rizzoni (1991: p.33) states, “the management of the firm is almost completely subordinate to the satisfaction of the owner’s need for status and autonomy”. Lack of financial resources and low management skills are also seen as inhibitors of innovation.

The second group, *traditional small firms*, operates in non-capital intensive industries, such as furniture, clothing, textiles and footwear, and are basically users of innovations developed “outside” the firm. Although considering the technical and scientific progress an exogenous process, traditional small firms are alert to innovation and are likely to adopt new technologies and processes when they appear in the industry. The attitude to adopt innovative processes is considered of great importance for achieving competitive advantage.

*Dominated small firms* are the ones that are sub-contracted to by large enterprises for a particular task or activity in the value-chain. The main aim of these firms is short-term survival and more autonomy. The innovation process is usually suggested by the contractor. *Imitative small firms* tend to operate in stabilised sectors performing specialised functions that allow them to co-exist with large enterprises (for example, the machine tools industry). These firms adopt innovative strategies which are complementary to those of large firms operating in the same industry.

*Technology-based small firms* operate in rapid-growth sectors where technology is frequently changing. They take advantage of technological opportunities by using the creativity and technical skills developed inside the firm. Researchers emphasise the role of high technology small firms in the innovation and performance of new industries (Oakey, 1991; Rizzoni, 1991). The last group, *new-technology-based small firms*, represents firms that operate within the limits of technological knowledge. The activity of these firms is very important for technological innovation. Rizzoni (1991) expresses this view in suggesting that they are “the birth of new industries” (p.38). These firms require in-house R&D and a dynamic and skilful management in order to adapt themselves to the new high-technological opportunities.

A recent study of innovation in Portuguese SMEs, concluded that it is not possible to find a standard or dominant behaviour in terms of innovation (Simões, 1996). From the analysis, a typology was developed that classified the enterprises studied into three groups:

- Enterprises that have an *active behaviour* for innovative products and processes, usually showing a relatively good use of IS/IT;
- Enterprises that have a *careful behaviour*, in the sense that they usually do not launch innovative products but that they are able to follow competitors and respond to competitive changes. These enterprises exhibit a satisfactory level of use of new technologies and organisational innovations;



- Enterprises with a *passive behaviour* where technology is considered an exogenous factor in strategic management. These firms are characterised by low use of IS/IT.

In this study, it was found that many Portuguese manufacturing SMEs do not tend to innovate, although these firms recognise technology and organisational innovation as important factors in achieving competitive advantage (Simões, 1996).

According to a cross-national study comparing SMEs' management of innovation in the UK, France and Portugal, Portuguese firms appear more reliant on outside sources for product/service innovation (Birchall *et al.*, 1996). As these researchers state, "competitors, formal linkages and informal networking, trade sources and equipment vendors are of more importance to the Portuguese" (Birchall *et al.*, 1996: p.296).

#### **2.6.2.5 - Attitudes towards IS/IT adoption and use**

Fuller (1996) emphasises the need to apply IS/IT according to the overall context of the business, involving the key-decision maker, the owner/entrepreneur. This researcher argues that "IT has potential to provide 'competitive advantage' for smaller businesses, but only a few small firms seem able to convert this potential into practice" (p.39). However, in a recent study of SMEs in the UK, Naylor and Williams (1994) reported that SMEs' managers have nowadays a better perception of IS/IT impact in their businesses and are well informed in IT matters.

The study of Naylor and Williams (1994) is one of the few exceptions in the use of case study research in this specific area of knowledge. These researchers analysed the successful use of IS/IT in 30 firms, on Merseyside (North-West England), with less than 200 staff and below £10 million annual turnover. Their findings point out that management skills to interact with IS/IT and the use of information in previously unplanned ways is vital for IS/IT success. Moreover, these researchers argue that the management style required to achieve IS/IT success is very similar to the one required for the development of the entrepreneurial firm.

Through six longitudinal case studies, Cragg and King (1993) found that owners' enthusiasm towards computing was the strongest motivating factor of IS/IT development in the SMEs analysed. Relevant inhibiting factors were: lack of IS knowledge, lack of managerial time, poor support and limited financial resources.

Surveying 500 small businesses with less than 50 employees and annual turnover below US \$3.5m (around £2.25m), Lai (1994) discovered that executives in small businesses were satisfied with their computer systems, yet, many did not perceive any correlation between computer use and cost efficiency or considered the use of IS/IT as a strategic tool.



DeLone (1988) concluded that the level of computer-based information systems success is positively associated with CEO computer knowledge and CEO involvement in the development of computer applications. This last hypothesis was also confirmed by Yap *et al.* (1992).

Values and attitudes of the senior management may play a critical role in the adoption of IS/IT in SMEs (Caldeira and Dhillon, 1996). Empirical evidence, from a large quantitative survey in SMEs, described by Ray *et al.* (1994), demonstrates that most owners and employees hold positive attitudes about the use of computers in the organisation. Although both groups also hold negative attitudes about computers, the level of their negative attitudes is far less than the level of their positive attitudes. Both, owners and employees, believe that information technology has had a positive influence on their enterprises. Moreover, owners see the computer as a major contribution to the firm's efficiency and profitability.

Managers' attitudes not only to the introduction of IS/IT but also to co-operation and partnership may play an important role in IS/IT development in the firm. Some types of IS/IT, like Interorganisational Information Systems, are the technological result of a more general business strategy that is likely to bring a deep change in the way business is done. These systems reflect the economic concept of globalisation at a micro and business level, opening the boundaries of the firm to partnership (Caldeira and Dhillon, 1996). Partnership requires honesty, co-operation and commitment (Bytheway and Dhillon, 1996) and these may cause significant changes in business processes and practices, requiring a shift in the mindset of managers in organisations (Caldeira and Dhillon, 1996).

### **2.6.3 - IS/IT competencies**

The concept of *IS/IT competencies* is related to several factors that have been pointed out in the literature as associated with IS/IT success: CEO computer knowledge (DeLone, 1988; Montazemi, 1988); users' computer knowledge (Montazemi, 1988 and Raymond, 1989); firms' IS/IT internal expertise (Cragg and King, 1993; Cragg and Zanatelli, 1995) or firms' IS/IT experience (Lees, 1987; Montazemi, 1988; Raymond, 1985; Yap *et al.*, 1992). The concept of *IS/IT competencies* adopted in this research is based on the work of Hamel and Prahalad (1996) and it is defined as a variety of skills, technology and knowledge related to the ability to adopt and use IS/IT in the organisation. Hence, several factors can be included within the concept of IS/IT competencies.

Stair *et al.* (1989) noticed that the majority of US owners/managers of small businesses had no formal IT education or training. On the other hand, SMEs in traditional manufacturing industries have scarce financial resources and cannot afford much of the



professional service available to large firms. As a consequence, these firms are likely to have low IS/IT expertise and low management competencies (Gordon and Key, 1987). The low managerial and technical expertise leads to the fact that managers tend not to evaluate properly the potential impact of IS/IT in the business and the initial computerisation of SMEs is normally done in an almost totally empirical manner (Raymond, 1989).

A survey conducted by Yap *et al.* (1992) concluded that computer-based information systems success is positively associated with the length of small business IS/IT experience. However, in most previous surveys the number of years of computer use has not been positively correlated to IS/IT success, defined in terms of level of computer utilisation and level of user information satisfaction (DeLone, 1988; Raymond, 1985; Montazemi, 1988). Therefore, as DeLone (1988: p.58) states, “a small business should not assume that the successful use of computers is something that will come in time with increased computer maturity”. Raymond (1985) explains that information technology is rapidly changing and recently computerised firms can benefit from more up-to-date technology with better software and hardware systems.

It is possible to find some inconsistencies in previous research. While Raymond (1985) found a negative association between the number of years of IS/IT experience and end-user satisfaction, DeLone (1988) and Montazemi (1988) found no relationship between these two variables. Moreover, Raymond (1985) concluded that users were slightly more satisfied in firms that developed a higher percentage of applications internally. DeLone (1988) could not establish any correlation between the same variables.

#### **2.6.4 - Organisational structure**

The literature refers to some examples on the association between IS/IT success and organisational structure. For example, Ein-Dor and Segev (1978) found that the level of centralisation of the IS/IT function is inversely related to firms' size. Raymond (1985) also concluded that, in SMEs, IS/IT success was positively related to the hierarchical level at which IS/IT was placed in the organisation. Moreover, Montazemi (1988), studying IS/IT in SMEs, identified a negative correlation between the level of centralisation of an organisation and user satisfaction with IS/IT.

Kagan *et al.* (1990) state that SMEs and large enterprises have different computer needs. As a small firm develops in size, its information needs tend to increase in level of sophistication. On the other hand, as the level of IS/IT application sophistication increases, the managerial span of control of the small business manager should decrease, implying that IS/IT is being tailored to more strategic and tactical applications.



In an early study, Ein-Dor and Segev (1978) concluded that firm's size is inversely related to the level of centralisation of the Management Information Systems (MIS) function. These researchers focused on the importance of the rank and location of the executive responsible for MIS and the existence of a steering committee to develop IS/IT in the organisation. According to Ein-Dor and Segev (1982), the IS/IT structure is strongly related to organisational structure which, in turn, is associated with organisational size.

Raymond (1985, 1987) also discovered that, in SMEs, MIS success was positively related to the hierarchical level of the MIS function, to the number of interactive applications and to in-house processing. Montazemi (1988) also found that the end-user is also more satisfied in less centralised organisations.

Using secondary data analysis, Brynjolfsson *et al.* (1994) provided some empirical evidence of an inverse relationship between IT investments and firm size. The hypothetical explanations are that IT can substitute human labour (the traditional one, though never proved) and that IS/IT leads to more outsourcing because it is likely to reduce co-ordination (information) costs more than production costs.

Most SMEs have a flat organisational structure with the CEO concentrating decision making in his own hands. The influence of the person responsible for IS/IT on the CEO seems to be important to understand IS/IT success. This is consistent with the literature. Baker (1987) stresses the importance of a formal appointment in SMEs of a top-ranking person to be CIO ("Chief Information Officer").

However, because of their size, many SMEs do not have an IS/IT department or an IS/IT manager. Usually the responsibility for IS/IT is given to a senior manager or to a professional with some computer experience and expertise (Lai, 1994).

In addition, the size of a business is not a static attribute. Many of the existing large organisations were small in the past. Several models were developed by researchers to describe small business growth (Churchill and Lewis, 1983; Greiner, 1972; Scott and Bruce, 1987). One of the most frequently cited models of small business growth, developed by Churchill and Lewis (1983), identifies five primary stages of small business growth that are related to firms' behaviour and management attitudes. These stages are: *existence*, *survival*, *success*, *take-off* and *maturity*.

In the initial stage, *existence*, the major concerns are obtaining customers and delivering the product or service. In this phase, the entrepreneurs concentrate their efforts on "keeping the business going" and formal planning is probably non-existent. When the business reaches the next stage, *survival*, it already demonstrated that it was a viable business. Generating enough cash to reach the break-even point should be the target. Systems development is supposed to be minimal and formal planning is likely to be in



an early stage, focusing basically on cash forecasting. This is followed by the stage of *success* in which, according to Churchill and Lewis (1983), the owners must decide whether to expand the enterprise or keep it small and profitable. Increasing organisational size may lead to the need of some professional management. In the *take-off* stage the key concerns tend to be how to grow rapidly and how can that growth be financed. Delegation should become a reality in order to improve managerial effectiveness. In the final stage, *resource maturity*, the firm is concentrated on consolidating and controlling the financial gains and on retaining some of the SMEs' characteristics that may have been an advantage in the past (for example, flexibility). In this phase, a professional type of management leads to the use of management tools like budgets, strategic planning and cost systems. The use of IS/IT is also likely to be an important requirement to sustain or improve the competitive position.

Several factors, which change in importance according to the stage where the firm is, are pointed out as determinants of small business success or failure. Churchill and Lewis (1983) identified eight of those factors. Four of them are directly associated with the enterprise: financial resources, personnel resources, systems resources (including IS/IT resources) and business resources (customer relations, suppliers relations, market shares, technology, manufacturing processes, etc). The remaining four factors are related to the owner: owner's goals, owner's operational ability in performing important business functions, owner's managerial ability and willingness to delegate responsibility, and owner's strategic ability to predict the future of the business.

The expansion of business activities and consequential firm's growth is often characterised as a shift from entrepreneurship to professional management (Watson, 1995). Charan *et al.* (1980) describe the entrepreneurial form by a highly centralised decision-making system, with firms' survival and growth overdepending on one or two individuals. Inadequate managerial skills and low training are common attributes in an entrepreneurial environment also characterised by a paternalistic type of relationship between managers and employees. In contrast, a professional type of management permits delegation of authority, uses a consultative and participative process of decision making with formal information analysis, and is less dependent on key individuals (Charan *et al.*, 1980).

According to Bhalla (1992), growth in small enterprises is often constrained by lack of financial resources, low level of marketing activities, low level of technical knowledge, inadequate product quality, and limited market size. The stage of growth is likely to influence the introduction of new technologies and processes in the organisation and, consequently, the adoption and development of IS/IT.



### **2.6.5 - Power relationships and user attitudes**

Power is an important subject that has been neglected in studies of IS/IT adoption and use in SMEs. A major problem with the study of power in organisations is that, citing Jackson and Morgan (1978: p.258), “power is extremely difficult to identify and measure objectively”. According to Finkelstein (1992), power is based on the ability to manage the firm’s uncertainty. A realist perspective of the social sciences considers power as a capability for action that is behind social relations. In this sense, power is not a property of a person but is inherent to a relationship between two social actors. Therefore, power can be perceived as a repressive mechanism of control and influence over others’ behaviour.

Jackson and Morgan (1978) introduce an interesting framework to study power in organisations which entails three dimensions: sources (resources and motivations), methods (modes of influence), and recipient (target’s role in the relationship: evaluation of source’s power and tendency to resist). French and Raven (1968) developed a well-known classification of types of power: reward power, coercive power, legitimate power, referent power, and expert power. Daily and Johnson (1997) define four types of CEO’s power in organisations: structural power, ownership power, prestige power, and expert power. These researchers claim that CEO’s power influences the financial performance of the firm and, on the other hand, CEO’s power is also likely to be affected by prior firm performance.

The CEOs’ power over other members of the firm is usually attributed to their legitimate authority and knowledge of the firm (Daily and Johnson, 1997; Roth, 1995). In many SMEs, the CEO has also ownership power, since he/she may be the founder of the firm and the owner, or a relative of the founder. Previous literature shows that founders usually have a strong organisational influence (Boeker, 1989). The hierarchical influence of the CEO is often accompanied by “social” recognition.

Since manufacturing SMEs usually have few stakeholders they are more dependent on the CEO (usually the entrepreneur and owner). This type of firms are also likely to have fewer problems in terms of organisational politics related to the implementation of IS/IT in the business (Heikkila *et al.*, 1991). Due to the fact that the CEO has a strong legitimate power, he has the authority to influence other members of the organisation in management decisions. In fact, and oppositely to research in large firms, the literature does not show any significant internal organisational conflicts as a consequence of the introduction of IS/IT in SMEs. While studies of IS/IT implementation in large enterprises usually report problems related to power conflicts and users’ resistance to change, in SMEs, research tends to be focused on technical issues and resource availability (Raymond *et al.*, 1990). However, even small businesses are complex social systems and simplistic interpretations of the existing processes and events should be avoided (Bowman and Jarrett, 1996).



Users' resistance to use IS/IT may result from an expected loss of power as a consequence of IS/IT adoption in the organisation or due to lack of qualifications to use the computer system. In a report from an empirical study involving 400 decision-makers in SMEs, Lees and Lees (1987) state that 56% of the users had neutral or negative expectations towards IS/IT adoption prior to implementation.

Because most firms have low levels IS/IT expertise, usually with, at most, one or two IS/IT professionals, the development of IS/IT makes the organisation dependent on IS/IT experts. These people may have a high expert power because they possess a relatively highly specialised knowledge upon which the organisation depends. This is less likely to happen in large organisations with large IS/IT departments. The literature also points out that usually the more satisfied CEOs are with IS/IT managers, the greater the influence IS/IT exerts on the top-level and, consequently, the importance of the IS/IT manager in the organisation decisions (Jones *et al.*, 1995).

Furthermore, stakeholders can also influence the decision of investing in IS/IT. In one of Cragg and King's (1993) longitudinal studies, although the firm suffered from economic difficulties, the owner was very keen to replace the oldest computer but "he felt that it would be impossible to justify such expenditure to the bank manager" (Cragg and King, 1993: p.55).

Another related and important subject is the influence of power in interorganisational relationships. For example, while large organisations that invest large sums in IS/IT may have strong bargaining power with their IS/IT suppliers, SMEs tend to have a weak bargaining power. SMEs are less attractive to software houses and other IS/IT suppliers. IS/IT vendors tend to develop short-term relationships with SMEs because the profit margins they may be able to get are not enough to provide good maintenance and after-sales services. At the same time, because SMEs have low IS/IT knowledge, they are more dependent on external support (e.g. vendors support).

## **2.7 - Factors related to the *External Context***

### **2.7.1 - External Expertise**

External support has been found to have a positive effect on IS/IT success in SMEs (DeLone, 1988, Gable, 1991; Lees, 1987; Martin, 1989). Thong *et al.* (1996) examining the relative importance of top management support and external IS/IT expertise in small business IS/IT implementation concluded that although top management support is very important, it is not as important as effective external expertise. The services provided by vendors may include providing hardware, software packages, technical maintenance, training and, sometimes, IS/IT consultancy. Moreover, Thong *et al.* (1996) argue that



for basic operational computer systems, a vendor can offer the same level of consultancy as specialist consultants.

Since SMEs, in general, have limited financial resources, low IS/IT skills and poor IS/IT management knowledge, they do not have the necessary conditions to develop appropriate information systems. For small businesses it may be not easy to attract and retain skilled information systems staff which makes these firms more dependent upon external IS/IT expertise, like consultant effectiveness and vendor support (Cragg and Zinatelli, 1995; Gable, 1991; Yap *et al.*, 1992).

However, small businesses frequently possess inflated expectations about the benefits achieved by the use of IS/IT and tend to overestimate the impact of hired consultants (Gable, 1991; Lees, 1987). In addition, the lack of resources limits the access to skilful and reliable consultancy. Furthermore, since SMEs have low internal expertise it is problematic to make an informed choice about the use of external support (Cragg and Zinatelli, 1995). As Kaye (1990: p.78) points out, “small organisations with limited internal expertise and resources are dependent on external expertise and their selection of technology but making consultants accountable and liable is problematic”. Lack of trust in outside sources of expertise as well as the low quality of the IS/IT services previously provided can also inhibit firms from relying on external expertise and support (DeLone, 1988).

### **2.7.2 - IS/IT availability**

The evolution of IS/IT is not spread equally amongst all countries and industries. Computer software specifically developed within a particular context, for example a country or industry, may not fit the requirements of another context. The availability of IS/IT is likely to affect the perceived level of IS/IT success.

Some research pointed out that IS/IT availability may be a significant problem for SMEs. For example, Cragg and Zinatti (1995: p.5), analysing the evolution of IS/IT in small firms, state that “results indicate a low level of IS sophistication regarding the firm’s application portfolio. This could be because packaged software for supporting other functional areas is not readily available. Thus, small firms will have to purchase custom-made software or develop their own applications...”

The review of the literature established that existing research failed to address the potential technology that is available in Portuguese manufacturing SMEs. In the initial fieldwork, several firms revealed that the quality of the software packages available in the market, for production management, was unsatisfactory. As a consequence, these firms started to develop their own software. In a similar way, systems integration seems to be difficult to achieve in the Portuguese manufacturing SMEs studied and, according



to many small business managers, is only possible with in-house software development. Evidence from initial fieldwork (presented in chapter 3) suggests that the quality and availability of information technology in the market may constitute an inhibitor or a facilitator of IS/IT success.

### **2.7.3 - Business Environment**

Because of their size, SMEs are generally described in the literature as more dependent and vulnerable to the environment. Their survival depends, to a large extent, on how the firm interacts with the environment (d'Ambroise and Muldowney, 1988).

Flexibility is frequently seen as an advantage of small businesses (Carson *et al.*, 1995; Mintzberg, 1991). Flexibility allows a better adaptation of the firm to environmental changes, for example, producing *just in time* in small lots to face the market demand for quick response (Manoochehri, 1992). This need to face an environment in rapid and permanent change leads to benefits from more flexible and adaptive organisational structures, like SMEs tend to be. The size of the business instead of being an inevitable disadvantage starts to be seen as a possible implicit advantage. Rainnie (1992: p.221) clearly expresses this view in suggesting that “the characterisation of the small firm changes from ‘small is brutal’ to ‘small is beautiful’”. Bhalla (1992) states that SMEs’ greater flexibility can make them more competitive by a selective and careful use of information technology.

Özcan (1995: p.11) argues that characteristics such as “competitiveness, flexibility, dynamism and innovativeness may become equally applicable to the large firm”. Nowadays, large corporations seek to take advantage of smaller firms and their added flexibility without being affected by diseconomies of scale in their management activities by developing networks with small firms (Paché, 1990). These networks are characterised by the large size of the management structure and the small size of their individual business and production units. Because of this strategy, SMEs may become dependent on large enterprises or operate basically within marginal markets (Özcan, 1995).

The development of networks and joint-ventures is a current trend in many European manufacturing industries (Bull *et al.*, 1993; Invernizzi and Revelli, 1993; Gaspar and Williams, 1991; Joyce *et al.*, 1995; Paché, 1990). It has been a way of collaborative strategies to emerge in order to overtake the disadvantages that arise from the small size of most manufacturing enterprises in traditional industries (Carvalho *et al.*, 1993; Pyke, 1994; Romão, 1998). The development of networks constitutes a possible solution for many Western small firms to beat the increased competition from large enterprises and manufacturing firms from new industrialised countries. For example, the cases of Emilia-Romagna in Italy, Valencia in Spain and Baden-Wurttemberg in Germany are



well known cases of successful regional co-operation between traditional manufacturing SMEs (Pyke, 1994).

The flexibility of small firms depends not only on collaboration between firms but also on the collaboration within them (Rainnie, 1992). Workers and managers share interests that can be exploited to improve the firm's efficiency. Dollinger (1984) evidences the importance of flexibility in SMEs by classifying flexibility as one of the proposed five measures of small business effectiveness (flexibility, productivity, satisfaction, profitability, resource and acquisition).

The use of *interorganisational information systems* (IOS), like EDI (Electronic Data Interchange), may support the development of business networks and many examples can be found in manufacturing industries (Benjamin *et al.*, 1990; Bytheway and Dhillon, 1996; Caldeira and Dhillon, 1997; Cash and Konsynski, 1985; Meier, 1995; Romão, *et al.*, 1996). SMEs need to examine their information systems strategy in collaboration with their partners and the literature reveals that the adoption of EDI in manufacturing SMEs is usually imposed by large customers (Braganza, 1993; Iacovou *et al.*, 1995). Business pressure is a significant factor to the adoption of IOS by manufacturing SMEs.

Examples can be found in the literature giving evidence of the role of global infrastructures and industry networks in providing information services useful for small businesses (Lu and Farrell, 1990; Mønsted, 1993). In some cases, government support was also found to be important for the successful adoption and use of IS/IT in SMEs. Yap and Thong (1997a, 1997b) describe the results of a small business computerisation programme in Singapore. This programme enabled many small firms to have access to IS/IT education, financial support, and IS/IT consultancy. Although important, government support, when it exists, is reflected in several other variables in the internal context and in the process of IS/IT adoption and use.

## **2.8 - Factors related to the *Process***

Process is defined as a set of actions that lead to IS/IT adoption and use in organisations. It relates to the models, techniques, frameworks and time of IS/IT adoption, along with the stages of IS/IT development in the firm (IS/IT planning and evaluation, IS/IT construction/acquisition, IS/IT implementation and benefits management).

### **2.8.1 - Stages, methods, techniques and frameworks used in IS/IT development**

The literature provides evidence for very limited levels of business strategic planning in SMEs. Equally, IS/IT formal planning appears to be almost non-existent. The results from a survey in manufacturing SMEs in the USA, conducted by Hagmann and McCahon (1993), showed that a large number of SMEs placed little emphasis on planning for information systems. Doukidis *et al.* (1992) found that the management of IS/IT in Greek SMEs was informal, ad-hoc, and that it addressed basically simple issues. Analysing a large sample of Canadian small enterprises with 20-249 employees, Raymond and Paré (1992) found that most of these enterprises exhibit a relatively low level of sophistication in terms of IT management. According to these researchers, “the managerial dimension is characterized by generally informal computerisation and IT planning processes” (p.13) and no request for planning documents.

Lybereas *et al.* (1993), analysing Greek SMEs, concluded that the management and planning of the IS/IT function is dependent on the organisational culture within which it takes place. Management style and organisational structure also influence significantly the process and nature of information systems planning. The decision over adopting and using computer systems is likely to be more based on personal values and beliefs than on systematic planning and evaluation of the strategic and operational impact of IS/IT in the business. Bergeron and Raymond (1992), looking at the potential of IS/IT to increase organisational effectiveness, concluded that it is possible to use IS/IT as a strategic weapon to maintain or improve SMEs’ competitiveness. These researchers developed a method for IS/IT planning in SMEs termed *ISCAs* (“Information Systems for Competitive Advantage”).

The method *ISCAs* entails five stages. First, it suggests the creation of a working group constituted by the owner/top managers, key employees and an outside consultant in the role of a guide and catalyst. The group must be aware of the potential benefits of IS/IT for the business and collaborate in the identification of computer applications that are relevant to their function. In a second stage, the concept of “Information Systems for Competitive Advantage” is introduced to managers and key employees. In the ensuing stage, the members of the planning committee must determine the organisational objectives, the strategy, the line of products, the customers, the suppliers, the



competitors, and the business strengths and weaknesses of the firm. In the fourth stage, a three dimensional strategic matrix is used to represent strategic objectives, competitive strategies and organisational activities. For each potential strategic target and competitive strategy, managers need to assess the potential for gaining competitive advantage from applying IS/IT to the activities of the firm. In the fifth and final stage, of “evaluation of the opportunities”, each opportunity found is submitted to a feasibility analysis, including the evaluation of the development and implementation costs, the benefits and organisational risks.

The method presented by Bergeron and Raymond (1992), does not cover IS/IT implementation and use where many problems occur in SMEs. Its boundaries end on the identification and evaluation of strategic opportunities to use IS/IT in the organisation. The process of information systems analysis is not considered either. On the other hand, since SMEs usually have low IS/IT expertise, most managers may not be able to assess the potential for gaining competitive advantage from applying IS/IT nor evaluating IS/IT costs, as the method suggests.

Gable (1991) analysing the development of information systems in small businesses recommends that firms should not attempt to purchase computers prematurely, instead an information systems requirement analysis should be undertaken, using an external consultant, if internal IS/IT expertise is unavailable.

Raymond (1985), in a survey involving manufacturing SMEs, concluded that users were more satisfied in firms that developed a greater portion of their applications in-house. Cragg and Zinatelli (1995) report that hardware and software selection is a common problem in SMEs. Cragg and King (1993) stress that the managerial time spent with the process of IS/IT development is very important to successfully develop IS/IT applications. According to these researchers, application growth tends to occur in SMEs where the owner/entrepreneur is enthusiastic about IS/IT.

### **2.8.2 - People involved in the process of IS/IT adoption**

According to Montazemi (1988), in SMEs, the presence of a systems analyst, the intensity of information requirements analysis, end-user computer literacy and interactive applications have a positive effect on end-user satisfaction. Interestingly, there is a lack of consistency in some research findings across studies. While Montazemi (1988) revealed a correlation between the presence of a systems analyst and end-user satisfaction, Yap *et al.* (1992) found no correlation between IS/IT success and the presence of a system analyst.

Raymond (1989) explains that the obstacles to a better and wider utilisation of IS/IT in small business are not technical in nature, but organisational and individual. It seems



important to study various degrees of utilisation to understand those obstacles which relate to success factors. Raymond *et al.* (1990) classifies the factors related to IS/IT success in three categories: the ones related to decision-making, with IS/IT adoption, and with IS/IT use.

### **2.8.3 - IS/IT training**

Raymond (1988) found that computer training and education exert an important positive effect upon small business managers' attitudes towards IS/IT and computer usage. According to Raymond, education and training promotes positive attitudes and computer use more effectively than does organisational IS/IT experience.

Blili and Raymond (1993) hold that, typically, SMEs have little expertise, experience and training in IS/IT management. Raymond (1989) explains that SMEs tend to conceptualise their needs in terms of a computer system rather than in terms of IS, that they do not have formal systems documentation, and that the users have insufficient preparation and training. Cerullo (1980) also identified the training of IS/IT personnel in the systems approach as a critical success factor in the design, development and installation of computer-based systems in organisations.

Studying SMEs' managers in Greece, Doukidis *et al.* (1992) established that Greek managers lack training and education in the IS/IT field. In 1985, a report from the Irish Management Institute (1985) had already pointed out that the lack of IS/IT knowledge and IS/IT training constituted a significant problem for the use of microcomputers in Irish small businesses. This is supported by a number of other studies that identified unsatisfactory levels of IS/IT training as one of the problems with IS/IT adoption in SMEs (Farhoomand and Hrycyk, 1985; Martin, 1989; Nazem, 1990; Schleich *et al.*, 1990) or recommended more computer training for small business managers (Baker, 1987; Coe, 1996; Raymond *et al.*, 1990).

## **2.9 - Factors related to the Content**

### **2.9.1 - Type of IS/IT**

Factors related to the content include the components and specifications of the existing computer-based information systems - the technology used (software and hardware), the people involved and the organisational impact. The computer systems identified in the manufacturing SMEs studied can be classified into four groups: administrative systems (or transaction processing systems, including: invoicing, payroll, accounting, etc), systems for manufacturing planning and control, CAD/CAM technology (Computer



Aided Design/Computer Aided Manufacturing), and IOS (interorganisational information systems).

In a large survey of the SME sector, in the USA, Kagan *et al.* (1990) found that the use of IS/IT is unique to each small business sector. The intensity of computing varies across sectors and firms, and the manufacturing sector has the largest proportion of firms that design their own software applications.

On the other hand, different levels of IS/IT satisfaction and factors inhibiting or enabling IS/IT success may be expected in the same firm, depending on the type of IS/IT used. This is because each type of computer system implies a different type of process to its development. For example, in the initial fieldwork, it was found that managers were satisfied with the existing administrative systems but low levels of user information satisfaction were identified for manufacturing planning and control software. This type of software is more complex and needs to be developed according to the specifications of the manufacturing processes which usually requires the development of IS/IT competencies.

Cragg and Zinatelli (1995) argue that inadequate hardware and software systems are frequently found in SMEs. The literature provides evidence that the number of administrative applications is correlated with IS/IT success (Raymond, 1985). In previous research, Raymond (1985) also found that IS/IT success was positively correlated with on-line applications and Delone (1988) reached similar conclusions for on-site computers. Although there is a strong potential for the use of IS/IT in SMEs at strategic level (Bergeron and Raymond, 1992; Raymond *et al.*, 1988), evidence from previous research suggests that IS/IT is more used by SMEs for administrative and operational applications rather than strategic decision-making purposes (Lincoln and Warberg, 1987; Malone, 1985).

### **2.9.2 - IS/IT objectives and assumptions**

The literature suggests that most CEOs' perceptions of IS/IT objectives and benefits are unrealistic or, on the contrary, underestimate the process of IS/IT adoption and use. Satisfaction with the existing computer systems seems significantly constrained by assumptions, expectations and beliefs about IS/IT impact in the business (Lees, 1987). Analysing the interaction between IS/IT users and IS/IT specialists during the design of an information system, Brabander and Thiers (1984: p.137) conclude that "organizational goals do not necessarily coincide with the goals of all participants, nor do official goals necessarily correspond with informal objectives".

The data provided by the initial fieldwork in consistency with the literature indicates that most manufacturing SMEs do not define any formal objectives for IS/IT. In order to



understand management satisfaction with IS/IT, it is important to understand stakeholder expectations and assumptions about the role of IS/IT in the firm. It is important to understand what are the formal and implicit expectations about IS/IT adoption and use in SMEs.

### **2.9.3 - Evaluation of IS/IT**

IS/IT evaluation is a difficult task. The use of cost/benefit analysis techniques, like *payback period* or *return on investment*, is unusual and their adequacy is questionable. More recent approaches look at intangible benefits and incorporate users' perceptions and satisfaction with IS/IT. User information satisfaction is usually defined as the result of the comparison of users' expectations and the perceived performance of IS/IT. User information satisfaction is widely mentioned in the literature as a surrogate measure of systems effectiveness (Gatian, 1994; Melone, 1990).

In this research, IS/IT evaluation will be based on CEO and other stakeholders' assessment of IS/IT adoption and use. Manufacturing SMEs tend not to have a professional type of management, operating usually on very low levels of IS/IT expertise with the CEO assuming a dominant role in decision making. In firms lacking internal expertise, IS/IT development appears to be rather based on CEO's values and assumptions than on a rational management analyses.

### **2.9.4 - Time of IS/IT adoption**

A significant part of the research that sought to identify IS/IT success factors in SMEs was done several years ago, when information technology was relatively expensive, had a low level of sophistication and therefore was little used in SMEs. Because of the fast development of IS/IT, time is an important variable when comparing different studies in this field. Some of the recent findings present substantial differences from the ones identified in early research.

In 1992, Raymond and Paré (1992: p.5,7) wrote that "more recently, other studies have broadened the research domain from traditional IS with transactional and administrative applications to include, under the umbrella of 'information technology', the new applications such as office information systems, CAD/CAM, computer-integrated manufacturing and electronic data interchange". Bonk (1996: p.76) explains that "the cost of information technology keeps decreasing and instant world-wide communication becomes increasingly available, even small enterprises can have information and communication resources to participate in world markets". Cragg and King (1993) suggest that IT growth should be studied in order to achieve a more complete understanding of small business computerisation.



The fast development of new IS/IT is likely to be reflected in the level of satisfaction with IS/IT adoption and use. The adoption of modern and more sophisticated IS/IT may change the competitive position of firms in a particular industry. While most empirical studies done in the 1980s were based on the use of administrative systems, designed to record and analyse business transactions, recent research includes more modern information technology, meanwhile adopted by manufacturing SMEs, such as CAD/CAM, MRPII, CIM (computer integrated manufacturing) and IOS.

According to previous empirical research, the time frame in IS/IT adoption is likely to be a significant factor to explain IS/IT success. Ein-Dor and Segev (1978) refer to the organisational time frame as a variable affecting the success or failure of IS/IT. Lees (1987) stated that small business IS/IT satisfaction and usage will be greater in organisations that have used computers for a long period of time. Raymond (1990) proposes a contingency approach that relates selected organisational factors, including time frame (amongst others, such as organisational size, maturity, resources, and IS sophistication), to user satisfaction and system usage.

Although the time factor may have a wide impact on several other factors that are related to the *context* and *process* of IS/IT adoption, it was classified within the *content* of IS/IT adoption because it directly impacts the type of systems being developed. The time of adoption is a relevant variable in understanding IS/IT success. Firms that recently started implementing IS/IT from scratch are more likely to find IS/IT solutions that fit their information requirements and may avoid several problems that emerge from the conversion of previous systems. The quality of IS/IT products and services available in the market is also higher and the tools and techniques available for IS/IT development are more sophisticated.

## **2.10 - Critique of the literature on IS/IT success factors in SMEs**

An evident issue established through the literature review concerns the difficulty of evaluating *IS/IT success*. The term *success* involves a subjective component and the situation becomes worse in the area of information systems. The literature review shows that in the last fifteen years IS researchers have been searching for accurate measures of IS/IT success, without finding a generally accepted evaluation form. User information satisfaction, an equally subjective concept, has been the most acceptable surrogate measure of IS/IT success.

Some inconsistencies were found in the literature review in the identification of IS/IT success factors. These inconsistencies are probably due to differences in the sample, in terms of geographical and temporal variations, and in the constructs used to evaluate IS/IT success. Moreover, most empirical studies are based on surveys relying on the

responses of entrepreneurs or finance managers who may not have been involved in the process of IS/IT adoption. Another potential bias to surveys in SMEs is related to the fact, pointed out by Pratten (1991: p.39), that “managers of firms with problems have greater difficulty allocating time for such inquiries and the evident prosperity of most of the sample firms pointed to this sort of bias”.

Most IS/IT studies in SMEs are theoretically weak and basically focused on the identification of factors related to IS/IT success. This study intends to go a step further providing a deeper understanding of IS/IT success factors in SMEs and their relationships. The analysis will be based on case studies, using a framework developed by Pettigrew *et al.* (1989) to study strategic change. This framework was adapted to the research subject, according to evidence found in previous empirical research on factors that enable and inhibit IS/IT success in SMEs.

Previous empirical research in the field failed to explore the relationships amongst the factors and between the dimensions of *context*, *content* and *process*. Therefore, these relationships will be discussed in chapter 3 after the analysis of the data gathered in the initial fieldwork.



## **Chapter 3**

### **Initial fieldwork and development of the research framework**

#### **3.1 - The objectives of the initial fieldwork**

Initial fieldwork was conducted through semi-structured interviews with CEOs, IS/IT managers/experts and other senior managers in six SMEs and one large enterprise in the Portuguese clothing and textile industry. These interviews were carried out between March and May of 1996. Since the large enterprise operates in the same industry as the SMEs, the analysis of the data was important for exploring differences that might exist due to the variation in size. These enterprises were selected because the clothing and textile industry fits the purpose of the research (traditional manufacturing industries) and also because the firms were already involved in a University project. This project was developed by a Portuguese school of management (ISCTE) with the aim of studying inter-firm co-operation. A previous contact with researchers in this University facilitated the access to the enterprises.

The objectives of this exploratory work were:

- a) To identify which issues related in the literature with IS/IT success could be recognised in Portuguese manufacturing SMEs;
- b) To discover further issues associated with IS/IT success that could be particular to Portuguese SMEs;
- c) To analyse managers' perception of the relative importance of the previously identified factors related to IS/IT success;
- d) To have an initial perspective of the actual levels of IS/IT adoption and use in Portuguese traditional manufacturing industries;
- e) To develop and test the structure of the interview for the main fieldwork and strengthen the researcher's interviewing skills and techniques.

Each interview lasted between one and two hours and all interviews were recorded on tape. Some interviews were done at the same time with the CEO and the IS/IT manager, others separately. In all enterprises, except one, the factory was visited and the existing IS/IT equipment briefly examined.

Most interviews were conducted in a relaxed environment, with the CEOs manifesting interest, looking unreserved, and seeming to be sincere. However, in few cases, the IS/IT managers (the person responsible for IS/IT) were apparently reserved and

expressed a defensive behaviour. In some instances, the presence of the CEO seemed to be intimidating (some questions might have been perceived as a way of evaluating his competence). In one other case, the absence of the CEO seemed to be a constraint. The IS/IT manager was discreetly trying to avoid some questions, that were perceived as sensitive, frequently suggesting that the CEO could probably provide more accurate information about the issues raised (showing uncertainty about the possible confidentiality of those issues). However, his behaviour changed towards the end of the interview when the CEO arrived and exhibited an open attitude.

Since the objective of the pilot study was to provide a general idea about factors that could be raised by managers and IS/IT people as related to the successful use and adoption of IS/IT in SMEs, the flexible and open form of interviewing appeared most adequate. In the following section, the relevant data from the pilot study will be presented and those issues that seemed relevant for the development of the research framework will be identified.

## **3.2 - The enterprises studied**

### **3.2.1 - Firm A**

#### **3.2.1.1 - Introduction**

*FIRM A* is a clothing enterprise that started operating 15 years ago. It generates an annual turnover of about £6.2m and employs 107 people. Although the enterprise has its own brand names, that provide autonomy and image, it also sells to subcontractors. The firm serves some large international customers, such as Levi Strauss, and exports represent 90% of the production. Despite the fact that the firm is considered to be in a healthy financial and economic situation, it does not employ an IS/IT expert and, in the opinion of the interviewees the previous process of IS/IT adoption was unsuccessful. Interviews were conducted, individually, with the CEO/owner and the commercial/IT manager, who is also in charge of IS/IT.

#### **3.2.1.2 - Issues related to the content, process and context of IS/IT adoption and use.**

To the commercial/IT manager, IS/IT is a tool that provides easy access to information. Nowadays, the firm is linked with customers through the use of fax and EDI. The firm uses EDI because "*customers want to be informed about everything that is happening related to the business. It was a customer's requirement*". The performance of IS/IT is



seen as reasonable but it *“should always be 100%, because computer systems are only a tool”*.

The firm does not employ an IS/IT professional because it is not considered relevant for the business:

*It makes no sense to have a systems analyst or a programmer. We do not do business because of them ... Business success does not depend on having the best IS/IT in the world, it is not because of IS/IT that we do business. The important thing is to make good deals with customers and generate profits that could be reinvested in IT and other areas of support.”* (Commercial manager)

Employees' levels of education in IS/IT are low - *“although Portugal is a European country with a very high number of computers, it is also one with low IS/IT education”*. External consultants had never been involved in IS/IT acquisition or development. The only support the firm had was provided by a software house. In the past, the enterprise suffered the experience of the *“low professionalism of an IT supplier and a self-made man, like many other that proliferate through the country - these people sell computers and software like they could sell newspapers”* (CEO/owner).

In this firm, manufacturing systems were better developed than information systems because, according to the commercial/IT manager, IS/IT does not bring success, it only facilitates work. However, recently the firm has started a process to acquire a new computer system and develop IS/IT.

In contrast, the CEO/owner sees IS/IT as very important for the business. In the past, he had an enormous desire to computerise the enterprise. Several years ago, he thought it could have been a good idea to have a monitor where he could record customers' orders and transfer that information to the factory, using a modem. In his view, it would have been possible to provide a better and faster service to the customer by winning time and accuracy. Because the firm used sales representatives in foreign countries (for example, in Sweden and Japan), the CEO thought about the advantages of a fast transfer of orders into production. However, the process of IS/IT adoption was not seen as successful:

*When we started introducing IT in the enterprise, computers should have been linked through a network. However, when the software was installed it did not work. There was a notorious incompetence from the supplier. The software was acquired through the hardware's supplier. The hardware supplier was someone that I knew and he contacted another enterprise to sell the software. Nine years ago about 8m escudos (£33,500) were spent in IS/IT. This investment provided low benefits, almost everything was stopped, including production management software. Some of the computers were never used.* (CEO/Owner)

### **3.2.1.3 - Summary**

The CEO and the IS/IT manager have different perspectives on the role and impact of IS/IT in the business. It was found in the interviews that, since the CEO has low level of expertise, he completely trusts the commercial manager on the adoption, development and use of IS/IT in the organisation. The commercial manager has an active and dominant role in IS/IT decisions. In this firm, financial resources were not identified as a constraint, on the contrary, the firm is considered to be in a relatively good financial situation.

Although the firm had a bad experience with the adoption of IS/IT, internal expertise or external consultancy in information systems are not seen by management as relevant. The emphasis is on the performance of the software supplier. The anxiety of the CEO to introduce IS/IT in the organisation and his low level of IS/IT expertise seems to have been a constraint for IS/IT success. The lack of internal expertise and the management perspective that "IS/IT is just a simple tool" (although the actual commercial manager was not in the firm at the time IS/IT implementation occurred) led to an underestimation of the complexity of the IS/IT adoption process. EDI was imposed by a large foreign customer and managers are satisfied with the information it provides.

#### **Major issues perceived as enablers or inhibitors of IS/IT success:**

- Incompetent software and hardware suppliers;
- Lack of IS/IT management knowledge;
- CEO anxiety to develop IS/IT led to unsuccessful systems;
- Employees have low IS/IT skills;
- The commercial/IT manager argues that there is no need for IS/IT internal expertise or external consultants;
- EDI successfully imposed by a foreign large customer.

### **3.2.2 - Firm B**

#### **3.2.2.1 - Introduction**

*FIRM B* is an enterprise in the clothing industry, with 137 employees, that sells knitwear clothes, pullovers, trousers, etc. In 1995, the enterprise had an annual turnover of around £2.53m and losses of £383,000. Despite the losses, results in 1995 were better than in 1994 and, according to the CEO, in 1996 the enterprise was expected to reach the break-even point. The firm started operating in 1987 and the CEO has been in the enterprise since 1994. A large percentage of production is exported (96%).



### 3.2.2.2 - Issues related to the content, process and context of IS/IT adoption and use.

The CEO and the financial manager are the people who decide on IS/IT adoption and use. The enterprise has also a systems analyst/programmer. The software for production management and control software were developed in-house and there is a package for accounting, salaries and invoicing. The production and commercial areas are integrated and the firm is currently involved in a process of IT upgrade and acquisition of an advanced software for production management. Like most enterprises in the industry, CAD/CAM is an existing fundamental technology.

Interviews were conducted with the CEO, with the computer programmer/systems analyst, and the financial manager who is also responsible for IS/IT. The interviews with the computer programmer and the financial manager were conducted simultaneously.

The CEO is very enthusiastic and supportive of IS/IT development because he believes that IS/IT is important for the business:

*I think that IS/IT may have a strong impact in the business. I was one of the first people to buy a fax in Portugal. Then I informed our customers that we had a fax machine, suggesting to them that they buy one. Furthermore, we almost forced suppliers to buy one. ... This year, 1996, we already spent about 15m Portuguese escudos (62.5 thousand pounds) on IT. (CEO)*

According to the CEO, IS/IT has an important role in the firm's strategy by supporting business relationships with their customers: "we want to get customers' loyalty by having our own 'design bureau'. Using the CAD system and a colour laser printer we simulate here, with customers, the mesh of the clothes. Then, data is transferred on a floppy disk to the sewing machines".

Although in the CEO's opinion the enterprise is not ready to use EDI, and no customer had suggested it, in his perspective the firm needs to start to consider EDI adoption:

*I am not going to wait, as soon as we are ready to work with EDI, I will be the first person to suggest it. We installed the internet three months ago. I am open to the use of network facilities to exchange information with customers or even develop products. I am waiting until we have enough know-how to do that. Our IT man went on a course and I also would like the commercial manager to go too, but he said he had no time. People like to be wanted and to notice that we think about their personal development. (CEO)*

The production and commercial areas are integrated. According to the CEO, IS/IT did not introduce any conflicts into the organisation, neither were there any problems with software suppliers. All managers accept IS/IT as essential to the business and all administrative employees know how to work with computers. The CEO sees the



performance of IS/IT as “reasonable” but after installing the new system for production management he expects it to be “good”.

*We know what we want and the IT person knows how to develop what we want. We spent one year installing the cost accounting system, which is an important one. A good production cost system is very, very important. Now when we analyse the cost of an order the value is estimated, after the installation of the system the value we will get will be the real one. It is important to know for each order whether we are going to earn or lose money. (CEO)*

The computer programmer/analyst explained that the firm is in the process of IS/IT development. A new Unix Pentium server will be bought “*because the system is slow and does not support more terminals*”. The package for administrative applications is reported as good, although vendor’s support is weak - “*we don’t even use all the facilities available in the package, ... but the software supplier has never satisfied us. He did not provide any post-sales service*”. On the other hand, the production management software covers the structure of the products (all information about sewing thread, buttons, ...) and it is the general opinion that it works well. The computer knowledge of people working with IS/IT is not perceived as a problem. However, employees experience problems when they change from one place to another and have to adapt themselves to a different function. Users also complain when new releases are developed.

In the opinion of the computer programmer/analyst it is difficult to find good software for production management and the competition suffered from the same problem. The computer programmer/analyst and the financial manager have been looking for a good package for production management, but most packages they find are disappointing. “*We have seen several software programs (even from an Italian enterprise) and they were not better than ours. Some manufacturing enterprises, like Renova (in the paper industry), sell the software they developed in-house. People say it is good, we have to see it.*”

According to the financial manager, some employees sometimes try to avoid and delay their participation in IS/IT courses - “*but we make some pressure and we do not accept excuses*”. Courses are usually done in the enterprise (for DOS, Windows and MS Office).

Both the financial manager and the computer programmer are of the opinion that the fact that the CEO is an IS/IT user is very important for the successful adoption and use of IS/IT in the business - “*the idea of introducing the internet in the enterprise was his idea*”. With the exception of the CEO, the other members of the board are classified as “paper users”, since they do not use computers “on-line”.



The financial manager and the computer programmer have the perspective that IOS will be important for the business. The financial manager reports that the firm is concerned about EDI development in the industry:

*Some time ago we (the financial manager and the computer programmer) went to a course about communications and we got the idea that EDI would be fundamental for this industry. Although customers never asked for EDI, we started to be afraid of not having any knowledge of EDI. Someday customers may ask us if we have EDI and we must be prepared. (Financial manager)*

### 3.2.2.3 - Summary

The availability of an IS/IT professional seems to be a strong enabler for IS/IT success (recognised by the CEO). In a similar way, the strong support that the CEO provides to IS/IT is also a facilitator of IS/IT success (mentioned by the financial manager and the computer programmer). The lack of good software for production management in the industry and the low quality of the services provided by the software supplier are seen as inhibitors of IS/IT success. IS/IT did not bring any conflicts to the organisation. The power to decide over IS/IT is centralised in the CEO and he seems to trust the computer programmer and the financial manager.

Interestingly, although *FIRM B* is in a difficult financial situation, the lack of financial resources is not seen as an inhibitor of IS/IT success. IS/IT is expected to contribute considerably to the necessary process of change by improving the firm's performance and, in terms of IS/IT sophistication, the firm seems to be one of the best equipped amongst those studied in the initial fieldwork - with integrated software, using *Product Data Management* and a sophisticated CAD/CAM system that enables collaboration with customers.

#### Major issues perceived as enablers or inhibitors of IS/IT success:

- CEO strongly supports IS/IT development;
- IS/IT internal expertise available;
- IS/IT development in house;
- Difficult in finding good software packages for production management;
- Low IS/IT vendor's support;
- Employees tend to avoid IS education;
- Managers accept well the use of IS/IT;
- Integrated computer systems;
- The CEO is open to inter-firm collaboration by the use of IOS.

### **3.2.3 - Firm C**

#### **3.2.3.1 – Introduction**

*FIRM C* is one of the oldest enterprises in the Portuguese textile industry (the firm started operating 150 years ago) with 470 employees and about £9.7m turnover, in 1995. The enterprise produces cotton towels and cotton textiles. Like many other Portuguese enterprises in the industry, the firm has recently faced serious economic and financial problems. In the 1980s, considerable investments (using bank loans) were done in spinning and sewing, based on growth expectations in the industry that did not occur. Recently, the enterprise started a reorganisation process that involved several phases. The financial problems were solved in introducing new partners and now the firm is trying to improve its business performance. The CEO joined the enterprise two years ago with the objective of developing the enterprise to achieve a better economic and financial situation.

#### **3.2.3.2 – Issues related to the content, process and context of IS/IT adoption and use.**

The hardware is essentially composed of an IBM C20 RISC, working with AIX, and several PCs. There are two professionals in IS/IT, one of them is responsible for the area. Only the CEO was interviewed, because IS/IT professionals were unavailable at the time the firm was visited.

One of the existing problems, related to the use of IS/IT, is that administrative and production systems are not integrated. In the CEO's opinion, IS/IT investments should also be made in the context of developing the human resources - *"our people do not have the necessary knowledge to manage an integrated computer system"*.

The planned IT investments are not considered high, around £125,000, and the enterprise is looking for government support to increase its IS/IT investments to £333,000. The CEO explained:

*Now we are investing, first in hardware and then in software. What we do not have is someone to co-ordinate production flow in order that the commercial and the marketing departments may provide a good service to the customer. We are looking for someone. Until then, I will co-ordinate that with the help of the IS person. In Portugal, until now, it is not possible to find good a information system that integrates manufacturing planning and control. There are also problems of integration between the 'mainframe' and the PCs. Sometimes information is duplicated. For example, the financial manager asks for information that is already available for the commercial manager. (CEO)*



Most software was developed in-house, in the IT department, with the support of a consultant who had some experience in developing IS/IT systems. The firm discontinued working with this consultant because of the difficult financial situation it faced in the recent past. On the other hand, the IS/IT expert was seen as a professional able to solve most IS/IT problems independently. Since most software was developed in house, there were no problems with IT suppliers.

There is no use of EDI because customers do not have it. However, the CEO thinks that, in the future, customers may suggest its use. In the CEO's opinion, from the existing customers, only *La Redoute* could be a potential partner for EDI links. *"In the medium term, IT is going to be an essential condition for business success. It won't bring success itself but it will be an essential condition. We must be linked with several customers through the use of computer systems in order to provide them good service and flexibility. Nowadays, IT has a supporting role in the business."*

Consultants are seen as a problem. A consultancy firm that had worked with *FIRM C* for a long time had a positive role in the turnaround project, but in terms of IS/IT, the services provided are not unsatisfactory:

*The 'consultancy firm' has good people and experience, but because we are here, in a small town, and we are a Portuguese enterprise, sometimes they send us weak consultants. In IS they are very bad. ... I think we should implement production systems that enable more flexibility (small orders, quick response, with modern techniques like JIT). They did not touch on any of these. They treat us like we were an enterprise in the 1940s or 1950s and tend to suggest systems that are now completely out-of-date. We are in the 1990s, trying to compete in the European Market, it makes no sense to implement methods that are already obsolete. (CEO)*

Employees are little educated in IS/IT: *"we are now having the same courses that other enterprises had six years ago. Although we have people with different levels of education (from the commercial director to production technicians) attending these courses, acceptance is very good"*. Regarding computer systems' acceptance, managers have different attitudes and levels of expertise. For example, IS/IT is seen as a fundamental tool for the production manager. On the other hand, the commercial manager is inexperienced with computers and is now attending a course. According to the CEO, *"the performance of IS/IT in the firm is "reasonable" (with some benevolence), but must be good in the near future ... It is too soon to speak about IS/IT benefits. The process of enterprise reorganisation had a first phase oriented to production systems. ... We are now investing in IS/IT, in order to provide conditions for future benefits, that I hope will be many"*.

### **3.2.3.3 – Summary**

In this firm, there are visible problems of IS/IT integration and a lack of proficient systems for production planning and control. Although IS/IT integration is an important issue, the CEO declared that the firm does not have the necessary knowledge to manage an integrated information system. In the management's opinion, employees also have low levels of IS/IT education.

The CEO also perceives consultants' low expertise as an inhibitor of IS/IT success. On the other hand, the difficult economic situation the firm is facing limits the use of external IS/IT expertise. In order to enable IS/IT acquisition, it is expecting government financial support (by sponsoring IS/IT projects). The CEO sees IT as an essential condition for business success and explicitly declares that, in his opinion, the most important condition for IS/IT success is the presence of a leader.

#### **Major issues perceived as enablers or inhibitors of IS/IT success:**

- Lack of IS/IT management knowledge;
- IS/IT consultancy has been weak;
- Financial problems restricted the use of consultants;
- No good software available in the market for production planning;
- Lack of IS/IT integration;
- Problems identifying information needs;
- The government supported the development of IS/IT in the firm;
- Employees have low IS/IT education;
- Perspective that people are the most important factor for IS/IT success - emphasis on strong leadership.

### **3.2.4 - Firm D**

#### **3.2.4.1 – Introduction**

*FIRM D* is a 100% family-owned enterprise in the clothing industry with 190 employees and £5m turnover, in 1995. Although the firm exports nearly the total of its production, it owns four shops in the north of Portugal that sells the firm's products. The enterprise intends to sell more medium-high quality products, based on small orders, but also wants to be more competitive in large orders using their own design and label. Now the firm has its own label but it is not registered. Quick response is seen as an important factor in improving the firm's competitiveness. Nowadays, customers want the product



to be delivered in a short period of time (for example, four weeks). An interview was conducted with the general manager, who is the son of the owner and the person responsible for IS/IT in the firm.

#### **3.2.4.2 – Issues related to the content, process and context of IS/IT adoption and use.**

According to the general manager, IS/IT is a major problem because *“it is a mess. It started to grow by islands. There was a need and a computer with a program (better or worse) was bought. Another system had problems and another computer with a program was bought, and so on.”* The software for production management and control is in a situation of stand by - *“we are waiting to find a person to develop it .... This was a little bit tragic. The person that was here trying to develop this software according to our specifications went away. People from the software house were nice and want to help us, but we do not have the right environment to implement the system now.”* The firm has been looking for software for production management and control, but *“some were too expensive, others too complex”*.

IS/IT is expected to have an important strategic role in the enterprise and there is a sort of informal plan for IS/IT adoption: *“We are organising production management, we need to standardise raw-materials using PDM (Product Data Management). When we have everything working properly then we will introduce IT. After this stage we will try to be linked with customers or suppliers through EDI. It is important to have a sustained growth and we will expand IS/IT to wherever we can ... We should have a central computer with terminals but investments on IT must be gradually made”*. From a commercial point of view, IS/IT is considered very important since it provides data about the products sold.

With the exception of CAD/CAM, other IS/IT courses were considered very bad: *“most software houses that sold their packages to us do not offer courses or the courses they offer are either very expensive or very weak”*. The firm never had IS/IT consultants - *“I know that I have IS/IT needs but I must do a cost-benefits evaluation, and we have priorities”*. The major problems found with IS/IT are:

*First, the quality of IT suppliers and then trying to implement a system without organising what we want to computerise. If I had been here before, the production management package would not have been bought because we did not have a production system organised in order to be computerised. That was the main problem, first buying a computer and then trying to solve the problem. The software was bought because the person that was leading the enterprise had some IS/IT knowledge as a user but he did not know how to manage IS/IT. The IT supplier, that is a sales person, was asked if the IS/IT solution that he was selling was capable of doing what we needed it to do and, of course, he said ‘yes - the software does that and much more’! Then the machine arrived and was left in a corner. (General manager)*

### **3.2.4.3 – Summary**

In this firm, lack of IS/IT management expertise and the low quality of IT suppliers were seen by the general manager as major inhibitors of IS/IT success. In his opinion, previous IS/IT delivered a low level of satisfaction because there was a tendency to implement IS/IT without restructuring the systems to be computerised.

Lack of financial resources is also seen as a significant constraint. Although the general manager recognises the need for better systems, he also sees that the firm is pursuing other priorities and, at the moment, is unable to invest in IS/IT.

The low quality of the courses provided by IS/IT suppliers is also seen as an inhibitor of IS/IT success. Software vendors provide low quality services, including IS/IT courses and the firm does not have an IS/IT professional yet, is currently seeking to select one.

#### **Major issues perceived as enablers or inhibitors of IS/IT success:**

- Low IS/IT expertise;
- Low quality services provided by software suppliers;
- Low quality IS/IT courses;
- Lack of IS/IT integration;
- Implementing IT without restructuring the systems to be computerised is a problem.

### **3.2.5 - Firm E**

#### **3.2.5.1 – Introduction**

*FIRM E* is a clothing and textile enterprise that started operating 30 years ago. The firm has 340 employees and generated an annual turnover of around £6.4m, in 1995. About 75% of its production is exported. Interviews were conducted with the accountant, who is the person responsible for IS/IT, and then with one of the entrepreneurs, who is one of the owners of the firm.

#### **3.2.5.2 – Issues related to the content, process and context of IS/IT adoption and use.**

According to the entrepreneur, IS/IT in the enterprise is now out-of-date. There are about 12 PCs linked through a Novell network, using packages for accounting, stocks, and invoicing. The warehouse was recently computerised and the firm is thinking about investing in a new CAD/CAM system.



The firm was involved in a project for the use of EDI in the industry, but the use of EDI in the industry had not increased as expected. EDI is still available but it is not in use: *"We were one of the first to adopt EDI but I do not think EDI evolution will be quick in this industry. To communicate through EDI is important to have senders and receivers."*

The firm works basically with one IS/IT supplier, but sometimes also deals with other IS/IT vendors. Their perceptions about IS/IT suppliers vary - *"some worse, others better"*. There was no involvement of external consultants in IS/IT adoption and use: *"we have been speaking directly with IS/IT suppliers"*.

The firm is looking to find good software for production planning. Several packages were analysed but none was considered good and suitable for the firm. A good system for production planning is perceived as extremely important for the firm.

The process of IS/IT development in the firm is continuous and slow. When a member of the organisation claims the need for a better or new software or hardware system, that request is analysed and if there are no financial constraints the product is bought. Users' IS/IT education is offered in the firm. Users accept well the introduction of IS/IT, although education is better accepted by younger employees.

Lack of time to organise information is seen as a major problem. In the managers' opinion, IS/IT success requires more IS/IT expertise. They state that IS/IT costs are not a problem, as long as the IS/IT performs well.

### **3.2.5.3 – Summary**

In the firm, IS/IT is out-of-date and the software is not integrated. Good software for production planning and internal IS/IT expertise are pointed out as major issues for IS/IT success. Despite the limited financial resources typical of SMEs, managers do not see IS/IT costs as a major constraint. Although the firm recognises that IS/IT may be important for the business, there is a passive attitude towards IS/IT development. In a similar way, the project for EDI adoption in the industry seemed to have failed. The main reason for that failure was lack of inter-firm co-operation.

#### **Major issues perceived as enablers or inhibitors of IS/IT success:**

- Lack of IS/IT integration;
- Good relationship with IS/IT suppliers;
- Problems with software availability for production management;
- EDI project failed because of lack of co-operation among firms.

### **3.2.6 - Firm F**

#### **3.2.6.1 – Introduction**

*FIRM F* is a small enterprise in the textile and clothing industry with 168 employees and 800m Portuguese escudos turnover in 1995 (about £333,000). The enterprise is facing a difficult economic situation. Interviews were conducted simultaneously with the CEO and owner of the firm and the general manager, who shares IS/IT decisions with the CEO.

#### **3.2.6.2 – Issues related to the content, process and context of IS/IT adoption and use.**

According to the general manager, the role of IS/IT is essentially supporting administrative tasks, and was developed according to users' needs. It is not an integrated system. Although the need for better IS/IT is recognised, there are other priorities. Accounting, personnel and invoicing are standard packages. A CAD system is also available. A spreadsheet program (in Lotus 1-2-3) is used to manage production planning. A young computer engineer worked, for two years, in the firm and supported the development of the existing systems.

There is no use of EDI. Since the product (clothing) is not a standard product, not a commodity, it is difficult to use EDI. When the design of the product is being done, no one knows exactly what it looks like.

Although in the CEO's perception, IS/IT has a limited strategic role in the business, he is of the opinion that the company has performance problems because the existing computer system does not properly support management activities. The CEO explained that IS/IT is being developed according to the evolution of the business: *"if we had had more orders IS/IT would be much more developed"*.

Both managers agree that there is no need to have a full-time person responsible for IS/IT, because it is basically a tool. Managers also reported that they do not have significant problems working with the existing computer systems. The firm has an employee who is a more knowledgeable user. This person helps with IS/IT matters.

In the past, there were some problems with software suppliers, but the software suppliers have been improving their applications and now there are no major problems. Software suppliers are seen as critical for the development of IS/IT within the firm. The general manager commented that *"equipment is not a problem, one goes to the supermarket and buys it, the major problem is the software"*.



### **3.2.1.3 – Summary**

Evidence suggests that the development of IS/IT in the firm is constrained by the difficult economic and financial situation that the firm is facing. Although both managers hold the view that IS/IT has a limited strategic impact, they explained that they would like to have better IS/IT for administrative and manufacturing management. IS/IT is out-of-date and it is not seen as a priority for the firm, because it is not perceived as a means to solve the difficult problems that the firm faces in the short term.

#### **Major issues perceived as enablers or inhibitors of IS/IT success:**

- No IS/IT integration;
- Lack of financial resources are a constraint for IS/IT development;
- CEO supports IS/IT development;
- IS/IT is essentially used for administrative purposes.

### **3.2.7 - Firm G**

#### **3.2.7.1 – Introduction**

*FIRM G* is a large enterprise in the clothing industry with 2,063 employees and around £72.46m turnover in 1996. It has 42 shops in Portugal and 13 in Spain. Products are recognised as medium quality. They are sold under four different brand names owned by the firm or sold without brand. Exports represent 50% of the total sales. Major foreign customers include Burtons and Calvin Klein.

#### **3.2.7.2 – Issues related to the content, process and context of IS/IT adoption and use.**

Three interviews were conducted. An introductory interview with the project manager lasted about 30 minutes, followed by a one hour interview with the IS/IT manager and a three hours interview with a member of the board of directors. In the interview with the director, three other individuals were also present: the project manager (who usually assists the member of the board, providing, when requested, more detailed information about operational issues) and two other researchers from the project that aims to study “inter-firm co-operation in the clothing and textile industry”. About 75 minutes were spent on exploring IS/IT issues as well as more general information about the firm to better understand IS/IT development in the enterprise.

The introductory interview with the project manager essentially provided general information about the firm. He expressed the view that the major problems the firm was

currently facing were related to market demand for “quick response” and the low qualifications of most middle managers.

With regards to use IS/IT in the firm, the director explained that over the previous three years the firm had invested about £1.35m in IS/IT and, currently, there was a project to integrate IS/IT applications. Many people offered some resistance to the introduction of IS/IT because it exposed the existing organisational inefficiencies. When the organisation started to look into integrating IS/IT applications in the business, organisational inefficiencies were found.

*IS/IT development brought some conflicts to the organisation and I believe that it will bring even more. We are talking about losing power. Department heads cannot keep information only to themselves. If someone asks something, they can no longer say that it is too complex or that they do not have time to do it. ... Cultural issues in traditional industries explain some inefficiencies. In Germany, where I worked before, it was easy to work, everyone was following the rules. Here there is a more father figure attitude.*  
(Director)

Product Data Management (PDM) is seen as very important for the business. The clothing industry has its own characteristics and, in the opinion of the member of the board of directors, there are only two solutions for the development of a PDM system, which are: buying a package and adapting it to the business structure or developing these applications in-house.

The director's level of satisfaction with IS/IT is very low but, recently, significant improvements have occurred. The CEO has been strongly involved in IS/IT adoption and, according to the director, he has computer knowledge and easily learns new computer skills.

IT costs were not seen as inhibitors of IS/IT adoption and use in the organisation: *“IT costs are not significant. We see them as necessary and IS/IT costs are not a constraint. On the other hand, employees' education is not easy, especially when people are not young anymore”*

The IS/IT manager, reported that there are 22 people in the IS/IT department: 10 in IS/IT support, 7 developing software applications and 5 trainees in the development of new applications. There were basically three IT platforms (AS/400, Novel Netware and Windows NT). The number of PCs was over 120 units, including the support of CAD/CAM applications. In the opinion of the IS/IT manager, CAD/CAM is the most important software for the firm but in the future PDM would be very important too. Currently, internal e-mail is available and the firm will soon have external e-mail and the internet. The IS/IT manager resumes the general situation of IS/IT in the enterprise in explaining: *“technically we are OK, we have enough human resources for IS/IT development and a clear idea about what we want.”*



The IS/IT manager explained that the EDI textile project in Portugal was discontinued in its early stages. It started with four enterprises and now there were only two left, this firm and one of its suppliers. Some tests were made and after that the enthusiasm was gone. In his opinion, the problem is simple. To implement EDI it is necessary to have an IS/IT infrastructure adapted to process data that is transmitted through EDI. It is not enough to have a machine with software and process the messages. It is essential to have applications prepared to work with EDI and neither the firm nor the supplier were in that situation. Now, both firms are preparing themselves to be able to work with EDI.

On the other hand, the firm is also interested in using EDI with international customers. The links through EDI with international customers are seen as more important and some contacts were made with foreign firms in the USA and in the UK. From a strategic point of view, EDI is seen, by the IS/IT manager, as extremely important. An existing problem is the lack of EDI standards for the textile and clothing industry. Furthermore, the changes in EDI standards take months before they are implemented. According to the IS/IT manager, it is not possible to wait so long. Moreover, another problem exists. For an unusual order, people want to have a signature on paper authorising it. Hence, it makes no sense to receive an order through EDI and wait until authorisation arrives. Consequently, paper is important for legal reasons.

In the IS/IT department there is the policy of looking first into the market for IS/IT solutions before developing them in-house. However, new applications must be integrated with the existing ones. The IS/IT manager states that: *"when we select a product we must be sure that the software house can maintain and improve the software application and allow us to adapt the application according to our needs. We have a mix of applications developed in-house and software developed by software houses. It is essential for us to have access to the source code in order to change the software applications we buy"*. Because of its size, the firm is able to have a dominant relationship with its IS/IT suppliers: *"We are happy with our software and hardware suppliers, otherwise they would have noticed"* (IS/IT manager).

The CEO was the major sponsor of IS/IT development and his support is seen as essential for IS/IT success - *"He is very interested in IS/IT and frequently asks for new features in IS applications"* (IS/IT manager).

User specifications are a major problem. Usually users do not specify properly what they want and as a consequence systems analysis is a complex task and takes a long time. As the IS/IT manager states, *"I used to say that IS/IT is a wonderful world, there is only one problem - the users"*. In the firm no standard method of systems analysis is used and systems analysis is seen as critical to the development of new application: *"I am the only person responsible for systems analysis. Systems analysis is too important to be delegated."* (IS/IT manager)

### 3.2.7.3 – Summary

CEO involvement is recognised by all managers as a determinant of systems success. Since this enterprise is large, the bargaining power with IS/IT suppliers is high and IS/IT internal expertise is available. There are no problems with IS/IT vendors - the firm knows what they want and how to get it. Managers identified a number of issues that seem to be a constraint for the use of EDI in the business such as lack of inter-firm co-operation, legal requirements, immature stage of the technology in the industry, and lack of expertise. Good systems analysis is also seen as important for the success of the software internally developed. The adoption and development of IS/IT is pointed out as having a strong impact in the organisation. It exposes organisational inefficiencies and opens departmental boundaries to internal co-operation. National culture is also mentioned by the top manager as having an effect in the way employees react to the adoption and use of new information technologies.

#### Major issues perceived as enablers or inhibitors of IS/IT success:

- IS/IT expertise available;
- In-house development;
- Strong CEO support for IS/IT development;
- CEO has high computer learning capability;
- IS/IT development shows organisational inefficiencies that leads to IS/IT resistance;
- Conflicts, power changing hands, difficulty in hiding information;
- Cultural issues identified as inhibitors of IS/IT development;
- IS analysis is seen, by the IS/IT manager, as extremely important for successful IS/IT development,
- There is the perspective that the EDI project failed because of lack of co-operation and lack of IS/IT expertise on the part of the partners;
- Strong co-operation with software and hardware suppliers (because the firm has high IS/IT expertise and strong bargaining power);



### **3.3 – Discussion of the findings from the initial fieldwork.**

The preliminary findings from the initial fieldwork did not identify resources availability as a major constraint for IS/IT success. Many firms, even in difficult financial and economic situations, do not see IS/IT costs as a major inhibitor to IS/IT adoption and use. It seems that IS/IT costs are perceived as inhibitors of IS/IT development only when the firm is in an extremely difficult economic situation, close to ceasing its activity.

The level of IS/IT education of the users in the enterprises studied was reported as low, as it could be expected in a traditional manufacturing industry that supports its competitiveness through low labour costs. However, managers did not point out users' lack of IS/IT skills as a cause of their low level of satisfaction with IS/IT.

CEO support towards IS/IT adoption was perceived by IS/IT managers and CEOs as very important for IS/IT development. Considering the relevance of the CEO in small firms (usually the entrepreneur and owner), it is understandable that CEO support is perceived by IS/IT managers as an important enabler for IS/IT success. However, a case was found (*FIRM A*) where the CEO's anxiety to develop IS/IT in the organisation led to IS/IT failure. Managers explained this situation by saying that the firm had low IS/IT expertise evaluating the process of IS/IT acquisition. In fact, the successful development of IS/IT in SMEs seems to be strongly related to the availability of internal expertise. Although CEO's support is normally an important facilitator of IS/IT success, widely referred to in the literature, if IS/IT expertise is unavailable, the CEO's lack of enthusiasm and low IS/IT management expertise may result in to the adoption of inappropriate information systems (as was the case in *FIRM A*).

IS/IT success appears to be related to the presence of a person in the firm that has IS/IT expertise and CEO's trust. This individual, in the role of IS/IT leader, is fundamental for supporting the adoption, implementation and use of IS/IT in the enterprise. This is the case in *FIRM B*, where the IS/IT professional (systems analyst/computer programmer) assumes a relevant role in selecting and developing IS/IT. Although *FIRM B* is emerging from an extremely difficult economic and financial situation, management shows higher levels of satisfaction with IS/IT than in any other of the SMEs studied. At a technical level, a clear example is the fact that *FIRM B* is one of the few firms studied that has integrated software.

Since SMEs are strongly dependent on the owner/CEO, they are likely to have fewer problems in terms of organisational politics related to the introduction of IS/IT in the business (Heikkila, 1991). In fact, the literature does not emphasise any relevant organisational conflicts as a consequence of the introduction of IS/IT in the firm and in the initial fieldwork SMEs' managers did not report any situation either. However,



internal organisational conflicts were identified in the large enterprise studied. Large enterprises are more complex and have more people, with specific managerial and operational tasks. Power tends to be more distributed and the number of stakeholders is probably higher than in an SME. Closer relationships amongst a large set of professionals, located in different places with different backgrounds and assignments, tend to be difficult to achieve. Conflicts of ideas and interests should be seen as natural and as Bowman and Jarret (1996: p.2) remark "conflict and differences are there to be managed". In an SME, power is usually centralised in the CEO function and managers easily communicate amongst them. The CEO often has family links with other senior managers and knows every employee relatively well. As a result, good social relations tend to be more frequent.

IS/IT failure is frequently perceived by CEOs as mainly related to the external context: low quality of the software available in the market, low vendors' performance, and low consultant effectiveness. Consequently, the literature reports that SMEs' managers tend to overestimate the impact of hired consultants and vendor support (Gable, 1991; Lees, 1987).

Many managers do not see IS/IT as critical for business performance. This may be due to their lack of IS/IT expertise. They seem to underestimate the time, effort and expense involved in IS/IT adoption and use (as explained in Lees, 1987). Although managers in the initial fieldwork perceive changes and new demands in the business (contrary to what the literature suggests), few recognise IS/IT as relevant for improving competitiveness. The CEOs of firms *B* and *G* (the large enterprise) believe that IS/IT has an important role in business performance and because of that they strongly support IS/IT development in the firm.

The use of interorganisational information systems in the industry (like EDI) seems to work when it is imposed by a large dominant customer, as it is suggested by the literature (Iacovou *et al.*, 1995; Braganza, 1993) and evidenced in *FIRM A*. Lack of inter-firm co-operation and low IS/IT expertise were frequently identified as inhibitors of IOS adoption.

Table 3.1 compares some of the findings in the preliminary fieldwork with the references in the literature about the subject. The framework based on the work of Pettigrew *et al.* (1989) was used to structure both the factors identified in the literature review and the ones found in the fieldwork. Some details about the initial interviews are also presented in the table. The last column includes an assessment of each factor based on its perceived importance (serious inhibitor, inhibitor, enabler, or essential enabler of IS/IT adoption and success) according to the views expressed by the interviewees. Since *FIRM G* was a large enterprise, references to this firm are printed in *italics*. *FIRM G* was included in the initial fieldwork because it may show some differences or similarities due to its size.



**Table 3.1 – Comparing the most relevant literature with preliminary fieldwork findings**

<u>Dimension</u>	<u>Literature Review</u>	<u>Field Work</u>	<u>Details from fieldwork</u>	<u>Imp.</u>
<b>Internal Context</b>				
<b>Resources</b>				
Financial resources availability	Cragg and King, 1993; Yap <i>et al.</i> , 1993. –	Firm C Firm F	An internal consultant left because the firm was having financial problems (and had to cut expenses). The firm is facing a very difficult financial situation that constrains IS/IT investments.	I SI
<b>IS/IT Competencies</b>				
Owner/CEO computer knowledge	DeLone, 1988; Montazemi, 1988; Baker, 1987.	Firm G	CEO computer skills.	E
Manager (including the CEO) IS/IT management knowledge and skills to interact with IS/IT	Naylor and Williams, 1994.	Firm A	Lack of IS/IT management knowledge.	SI
User computer knowledge	Montazemi, 1988; Raymond, 1989.	Firm A Firm C	Employees have low IS/IT skills. Employees have low IS/IT education.	I I
Firm's IS/IT internal expertise	Cragg and King, 1993; Cragg and Zinatelli, 1995.	Firm B Firm C Firm D Firm G	IS/IT development in house. IS/IT expertise (2 people), although important, not enough; No IS/IT staff. IS/IT expertise available in-house.	EE E I EE
Firm's IS/IT experience	Yap. <i>et al.</i> , 1992; Lees 1987; Raymond, 1985; Montazemi, 1988.			
<b>Management support and attitudes towards IS/IT</b>				
Owner/CEO support and commitment to IS/IT adoption and use	Cheney, 1983; Herberg and Bradley, 1983; Ginzberg, 1981; Yap <i>et al.</i> , 1992; DeLone, 1988, Gable, 1991; Thong <i>et al.</i> , 1996.	Firm A Firm B Firm G	CEO's anxiety to develop IS/IT contributed to the development of an unsuccessful system. Strong CEO's support and commitment to IS/IT development (including EDI). Strong CEO support towards IS/IT adoption	SI EE EE
Managerial time spent with IS/IT issues	Cragg and King, 1993; Cragg and Zinatelli, 1995.			
Management attitudes towards co-operation (that affect the adoption and use of IOS)		Firm E Firm G	EDI is available but not in use (lack of co-operation between firms). Lack of co-operation is pointed out as one of the reasons why the initial EDI project failed.	I I
<b>Power relationships and users' attitudes</b>				
CEO/CIO relationship 2)	Jones <i>et al.</i> , 1995			
User attitudes towards IS/IT use	Lees and Lees, 1987.	Firm B	Users do not accept new releases well and tend to avoid IS/IT education.	I

			Firm G	IS/IT development shows organisational inefficiencies that employees try to hide. Users resistance to use IS/IT;	I
<b>Organisational Structure</b>					
CIO a top-ranking person		Baker, 1987; Ein-Dor and Segev, 1978.			
Organisational level of MIS function		Raymond, 1985.			
Level of centralisation of the organisation		Montazemi, 1988.			
<b>External Context</b>					
<b>External Expertise</b>					
Vendor's support		Yap <i>et al.</i> , 1992.	Firm B	Managers were unhappy with the performance of the software supplier (did not provide technical support).	I
IS/IT external expertise		Thong <i>et al.</i> , 1996			
<b>Technology Availability</b>					
Quality of IS/IT products available in the market		Nazem, 1990;	Firm B	Low quality of the software for production management and production planning available in the market.	I
			Firm C	Low quality of the software for production management and planning available in the market.	I
			Firm E	Low quality of the software available for production management.	I
<b>Business Environment</b>					
External environment		Lees, 1987.			
Influence of customers and suppliers in the adoption and use of IS/IT		Iacovou <i>et al.</i> , 1995	Firm A	The use of IOS was imposed by the customer, a large foreign enterprise.	EE
<b>Political</b>					
Government support to IS/IT adoption		Yap, Thong and Raman, 1994.	Firm C	New IS/IT investments are supposed to be partially sponsored by government funds.	E
<b>Social</b>					
<i>The influence of customers and suppliers in the adoption and use of IS/IT and the involvement of consultants, vendors and other external actors has also a social dimension</i>					
<b>Process</b>					
<b>Models, techniques and frameworks used</b>					
Intensity of information requirement analysis		Montazemi, 1988.	Firm G	IS analysis is seen as a critical issue for IS/IT development.	EE
Formal systems analysis and design		Lees, 1987; Ein-Dor and Segev, 1978; Montazemi, 1988.			
Cost/benefit analysis		Raymond, 1989.			
Needs conceptualised in terms of computer systems rather than in terms of an IS		Raymond, 1989.	Firm D	Implementing IT without restructuring the systems to be computerised.	SI
Hardware and software selection		Cragg and Zinatelli, 1995			



IS/IT training					
Quality of IS/IT training available			Firm D		Low quality of courses in IS/IT.
<i>Content</i>					
<b>Type of IS/IT</b>					
The use off on-site computers		DeLone, 1988.			
On-line applications		Raymond, 1985.			
The number of administrative (rather than transactional) applications		Raymond, 1985.			
Compatible and integrated systems		Baker, 1987.	Firm A Firm B Firm C		IS/IT is not integrated. IS/IT integration. Lack of IS/IT integration.
<b>IS/IT Objectives and Assumptions</b>					
Management expectations about the IS/IT benefits and impact in the business		Lees, 1987.	Firm A  Firm B Firm C  Firm F		The marketing/IS manager has low expectations about the contribution of IS/IT for business performance while the CEO has high expectations. The CEO sees IS/IT as having an important role in the business. Limited role of IS/IT in the business. Management has other priorities for investments. Limited role of IS/IT in the business.
Management overestimation of the impact of hired consultants and vendor support		Lees, 1987, Gable, 1991			
Management underestimation of the time, effort and expense involved in IS/IT adoption and development		Lees, 1987.	Firm A		Underestimation of the process of IS/IT adoption.
<b>Evaluation of IS/IT adoption and use</b>					
Management inflated expectations about IS/IT benefits		Lees, 1987.			

1) Perceived importance of the factor: SI - Serious Inhibitor; I - Inhibitor; EE - Essential Enabler; E - Enabler.

2) The sample also included large firms.

### **3.4 - Interdimensional relationships**

It is argued in this research that IS/IT success in manufacturing SMEs cannot be understood by analysing separately the different elements of the research framework. In order to understand and explain IS/IT success, it is necessary to understand the connections and linkages between the elements related to the content, the context and the process of IS/IT adoption and use. It is their interactions that interdependently determine relative success in the adoption and use of IS/IT in manufacturing SMEs and define the social structures and mechanisms that indeed enable or inhibit IS/IT success. It is important to note that the separation of those dimensions in the research framework is only a helpful analytical device to facilitate understanding IS/IT success, since these dimensions are inextricably interlinked. Previous research in the field did not look at relationships and usually tried to identify, by the use of surveys, isolated factors that were correlated with “user information satisfaction”, failing to explore the structures and mechanisms that may provide an explanation for IS/IT success. Those social structures and mechanisms involve several dimensions and their inter-relationships.

#### **3.4.1 - Context / Process**

Data from the initial fieldwork indicates that the SMEs that successfully adopt and use IS/IT develop their own internal competencies in order to manage the process of IS/IT development. Moreover, IS/IT success in the manufacturing SMEs studied seems to be related to the presence of a person that has IS/IT knowledge, CEO trust and a perspective of IS/IT use according to the business orientation of the firm.

Unsuccessful firms with IS/IT adoption and use tend to underestimate IS/IT planning and evaluation, and managers do not have a clear perspective about their role in the process of IS/IT development. Although the literature stresses the importance of CEO support and commitment to IS/IT adoption and use (Cheney, 1983; DeLone, 1988; Gable, 1991; Herberg and Bradley, 1983; Thong *et al.*, 1996; Yap *et al.*, 1992), the initial fieldwork suggests that CEO support does not necessarily lead to IS/IT success if the firm has low internal or external IS/IT expertise. In fact, CEO support seems to constitute a necessary condition for IS/IT success but not a sufficient one. Many managers in traditional manufacturing SMEs do not perform any strategic planning and do not have a clear perspective on the impact of IS/IT in the business, nor of the process of IS/IT development. Managers sometimes see IS/IT as a tool, do not realise the complex organisational impact of these technologies and do not know how to manage the process of IS/IT development.



### **3.4.2 - Context / Content**

The type of IS/IT to be developed is also constrained or enabled by the top management perspective of the potential impact of IS/IT in the firm, resource availability, IS/IT competencies or clients' pressure to adopt IS/IT (for example with EDI technology). The demands and competencies of traditional manufacturing SMEs, with more limited resources and moderate objectives, leads to information systems different to those available in large organisations. IS/IT objectives and assumptions are the result of existing IS/IT competencies and resources (usually low), as well as management perspectives and assumptions about the role of IS/IT in the firm.

For example, the use of IOS (Interorganisational Information Systems) in Portuguese manufacturing SMEs seems to be basically constrained by lack of trust and co-operation amongst managers and lack of knowledge to adapt IS/IT in order to get the full benefits of IOS. Managers' attitudes to co-operation and partnership seem to play an important role in the development of IOS.

In this research it is argued that although traditionally SMEs lack financial resources, IS/IT costs are not seen as a major inhibitor of IS/IT success, except when the firm is in an extremely difficult financial and economic situation. IS/IT investments are fundamentally based on expectations about IS/IT benefits. Managers invest in IS/IT if they believe IS/IT will fulfil their information needs.

### **3.4.3 - Process / Content**

The Process / Content relationship intends to explain the interaction between the way IS/IT is developed in the organisation through its different phases (planning and evaluation, construction or acquisition, implementation, and benefits management) and the type of computer system that emerges from this process. Each type of computer-based information system (administrative, manufacturing management, CAD/CAM, IOS) seems to depend on its own, specific success factors varying by the level of complexity of the process of IS/IT development. This has been almost ignored in the literature, probably because most of previous research in the field was conducted several years ago, when SMEs usually had low levels of IS/IT adoption and use, and were basically using administrative software.

From the initial fieldwork, it was found that managers were usually satisfied with the available administrative systems but showed low levels of "user information satisfaction" with systems for manufacturing planning, management and control. This latter type of software is more complex and needs to be designed according to the specificity of the manufacturing processes. To adequately develop computer-based information systems, firms may have to improve their internal IS/IT competencies. Most

managers report that the software available in the market fails to meet their organisational requirements, and also it is difficult to adapt externally acquired production management software to the firm's manufacturing specifications.

### **3.5 - Summary of the initial findings and initial propositions for research.**

From the initial fieldwork the following descriptions of the situations of SMEs can be considered as initial propositions that need further investigation in order to clarify and understand the combinations of factors that are likely to affect success with IS/IT adoption and use in manufacturing SMEs in Portugal. These *propositions* are affected by relationships amongst the *context*, *process* and *content* dimensions (see table 3.2).

The analysis of the data collected in the initial fieldwork leads to the argument that in order to develop IS/IT competencies, the presence of a person (IS/IT leader/champion) that has CEO trust and a perspective of IS/IT use according to the business strategic orientation of the firm seems to be important. This "IS/IT leader/champion" is essential in a series of ways: to analyse the strategic and operational impact of IS/IT in the business and evaluate its benefits; to expand CEO knowledge of the impact of IS/IT in the business; and to develop internal IS/IT competencies for managing and implementing IS/IT in the firm according to the business needs.



**Table 3.2 – Initial propositions for case study analysis**

	Issues	External Context	Internal Context	Process	Content
a)	CEO's support, although important to IS/IT adoption and use, does not necessarily lead to IS/IT success if the firm has low IS/IT expertise (internal and external).	X	X		
b)	The successful adoption of IS/IT in manufacturing SMEs is related to the presence of a person that has IS/IT knowledge, CEO's trust and a perspective of IS/IT use according to the business strategic orientation of the firm.		X		
c)	Although most firms have low IS/IT expertise, consultants are not seen by CEOs as necessary in the process of IS/IT development. External IS/IT consultancy in manufacturing SMEs is not perceived as good. On the other hand, manufacturing SMEs do not seem attractive for experienced IS/IT consultants.	X	X		
d)	IS/IT failure is usually perceived by CEOs as mainly related to the low quality of software available and low vendors' performance. Many firms do not realise the need to develop their internal competencies.	X	X		
e)	Lack of good software available for production management seems to be a problem for the firms in the industry. These SMEs have problems in adapting the existing software to the specifications of the industry because they have low IS/IT expertise and lack of bargaining power with software houses.	X	X	X	X
f)	Lack of systems integration is a common problem in SMEs and reflects their low IS/IT expertise, low IS knowledge and also lack of financial resources.		X		X
g)	Although manufacturing SMEs traditionally lack financial resources, IS/IT costs are not seen as a major inhibitor of IS/IT development.		X	X	
h)	Because SMEs have low IS/IT knowledge, the benefits that CEOs expect from the use of IS/IT vary considerably across firms, essentially according to personal beliefs. Most CEOs' perceptions of IS/IT benefits are unrealistic or, on the contrary, underestimate IS/IT use. Satisfaction with the existing systems seems significantly constrained by the expectations and beliefs about IS/IT benefits.		X		X
i)	Internal conflicts related to power changing hands as a consequence of IS/IT implementation and development tend to be perceived by large enterprises but not by SMEs in manufacturing industries. SMEs have a more simple and flat organisational structure with a dominant role of the CEO/owner and a family type relationship between managers. IS/IT development is not perceived as able to produce a significant change in the way power is distributed.		X		
j)	Links between Portuguese enterprises, using interorganisational information systems, are basically constrained by lack of co-operation between managers and lack of knowledge to adapt IS/IT in order to get the full benefits of IOS. Successful EDI use in the firms studied was imposed by a large customer.	X	X		X

### **3.6 - The framework to study IS/IT in SMEs.**

Based on the framework developed by Pettigrew *et al.* (1989), the factors affecting success in IS/IT adoption and use can be classified into a number of categories. The framework was developed for understanding strategic change through the analysis of three core dimensions: *context*, *process* and *content*. The sub-dimensions presented in this framework were adapted and extended to the purpose of studying IS/IT adoption and use in SMEs. This was based on the factors that were identified in the literature as affecting IS/IT success in SMEs and the evidence gathered from the initial fieldwork (see table 3.1).

Issues raised in the initial fieldwork, and presented in this chapter, were added to the framework in order to obtain a more complete perspective of the factors that affect IS/IT success in Portuguese manufacturing SMEs (see table 3.1). Based on this data, a *check-list* (figure 3.1) was developed to structure the interviews and data collection in the main fieldwork (see also appendix – for interview schedule).

Figure 3.1 shows the structure used to collect and analyse the data in the major case studies. This structure is based on the factors identified in previous empirical research and was tested and refined with the data collected in the initial fieldwork. The codes presented in figure 3.1, in *italics*, are equivalent to those that have been used in the software package *NUD\*IST* to classify and analyse the data.

Government support towards IS/IT development will be further analysed in terms of a potential source of financial resources, because the existing services provided by the Portuguese government are basically financial aid for IS/IT investments, based on development programmes, some of which are being supported by European funds.

Table 3.3 exhibits the initial propositions previously presented in table 3.2 yet adding some references to the interview structure (*case study check-list*) that guided the process of data collection. The complete interview structure can be found in *Appendix A*. However, since the interviews were semi-structured, the interviewees were free to comment, at any time, any issue related to the subject. Therefore, many interviews did not follow the order of the items in the *check-list*. The role of the *check-list* was only to help conducting the interview and checking if all potential factors were approached and discussed.



## **1. Internal Context**

### **1.1 – Resources**

1.1.1 - Financial resources availability; <IC:finan>

1.1.2 - Qualification of human resources; <IC:human>

### **1.2 Management perspectives and attitudes towards IS/IT <IC:manag>**

1.2.1 - CEO support;

1.2.2 - Managers attitudes towards IS/IT;

### **1.3 - IS/IT Competencies <IC:compe>**

1.3.1 - CEO's IS/IT knowledge;

1.3.2 - Managers (including the CEO) IS/IT skills;

1.3.3 - Users' IS/IT expertise;

1.3.4 - IS/IT department/experts;

1.3.5 - IS/IT experience;

### **1.4 - Organisational structure <IC:struc>**

1.4.1 - Location of MIS function in the organisational structure;

1.4.2 - Level of centralisation of the organisation;

1.4.3 - Organisational size;

### **1.5 – Power relationships and user attitudes**

1.5.1 – Power relationships; <IC:power>

1.5.2 - Users acceptance/resistance to IS/IT use; <IC:user>

## **2. External Context**

### **2.1 – External expertise**

2.1.1 – IS/IT vendor's support; <EC:vendo>

2.1.2 - Consultants involvement and effectiveness; <EC:consu>

### **2.2 – Technology <EC:techn>**

Quality of the software and hardware available in the market;

### **2.3 – Business <EC:busin>**

Influence of customers and supplier in the adoption and use of IS/IT;

### **2.4 - Political (further considered as related to the availability of financial resources)**

Government support towards IS/IT development

## **3. Process**

### **3.1 – People involved <PR:peopl>**

### **3.2 – Models, techniques and frameworks used <PR:model>**

### **3.3 – IS/IT training <PR:train>**

### **3.4 - Stages followed in IS/IT development <PR:devel>**

## **4. Content**

### **4.1 - Type of IS/IT solutions available in the firm <CO:type>**

### **4.2 - Objectives and assumptions about IS/IT <CO:objec>**

### **4.3 - Evaluation of IS/IT benefits <CO:evalu>**

### **4.4 - Time of adoption <CO:time>**

Figure 3.1- Structure for data collection and data analysis in *NUD\*IST*  
Source: Compiled by the author

**Table 3.3 – Cross-references of initial propositions to case study *check-list***

No.	Initial propositions	Key points in the <i>check-list</i>
a)	CEO's support, although important to IS/IT adoption and use, does not necessarily lead to IS/IT success if the firm has low IS/IT expertise (internal and external).	2.17; 2.18; 2.20; 2.24; 2.25; 2.26; 2.33; 3.10;
b)	The successful adoption of IS/IT in manufacturing SMEs is related to the presence of a person that has IS/IT knowledge, CEO's trust and a perspective of IS/IT use according to the business strategic orientation of the firm.	1.2; 1.4; 2.6; 2.7; 2.19; 2.33; 3.10;
c)	Although most firms have low IS/IT expertise, consultants are not seen by CEOs as necessary in the process of IS/IT development. External IS/IT consultancy in manufacturing SMEs is not perceived as good. On the other hand, manufacturing SMEs do not seem attractive for experienced IS/IT consultants.	2.20; 2.24; 2.25; 2.26; 2.27; 2.33; 2.34; 3.10; 3.12; 4.3;
d)	IS/IT failure is usually perceived by managers as mainly related to the low quality of software available and low vendors' performance. Many firms do not realise the need to develop their IS/IT competencies.	2.33; 2.34; 3.10; 3.11; 3.12;
e)	Lack of good software available for production management seems to be a problem for the firms in the industry. These SMEs have problems in adapting the existing software to the specifications of the industry because they have low IS/IT expertise and lack of bargaining power with software houses.	2.15; 2.21; 2.24; 2.25; 2.26; 2.27; 2.33; 2.34; 3.10; 3.11; 3.12;
f)	Lack of systems integration is a common problem in SMEs and reflects their lack of IS/IT competencies.	2.15; 2.24; 2.25; 2.26; 2.27; 2.34; 3.11; 4.6;
g)	Although manufacturing SMEs traditionally have a lack of financial resources, IS/IT costs are not seen as a major inhibitor of IS/IT development.	1.10; 2.11; 2.12; 2.15; 2.34; 3.11;
h)	Because SMEs have low IS/IT knowledge, the benefits that CEOs expect from the use of IS/IT change considerably from firm to firm, essentially according to personal beliefs. Most CEOs' perceptions of IS/IT benefits are unrealistic or, on the contrary, underestimate IS/IT use. Satisfaction with the existing systems seems significantly constrained by the expectations and beliefs about IS/IT benefits.	2.6 2.13; 2.14; 2.18; 2.24; 2.25; 2.26; 2.27; 3.11; 4.5;
i)	Internal conflicts related to power changing hands, as a consequence of IS/IT implementation and development, are perceived by large enterprises but not by SMEs in manufacturing industries. SMEs have a more simple and flat organisational structure with a dominant role of the CEO/owner and a family type relationship between most managers. IS/IT development is not perceived as able to produce a significant change in the way power is distributed.	1.2; 1.4; 1.12; 2.16;
j)	Links between Portuguese enterprises, using interorganisational information systems, are basically constrained by lack of co-operation between managers and lack of knowledge to adapt IS/IT in order to get the full benefits of IOS. Successful EDI use in the firms studied was imposed by a large client.	2.3; 2.4; 2.8; 2.7; 2.15; 2.34; 3.11; 4.6;



### 3.7 – Summary

In this chapter the initial fieldwork was presented. The purpose of the initial fieldwork was to identify, in the interviews with top managers and IS/IT managers, factors that could be related to IS/IT success in Portuguese SMEs. The data gathered in the initial fieldwork were then compared with previous empirical work, in order to develop a structure for data collection, a framework for data analysis, and define some initial propositions that appear relevant for examination in the major case study research phase.

In view of the objectives pursued in the initial fieldwork (described at the beginning of this chapter), the following was found:

a) The initial fieldwork confirmed as applicable to Portuguese SMEs most IS/IT success factors pointed out in the literature, as can be seen in table 3.1. Although the Portuguese national culture as well as the level of development of the Portuguese IS/IT industry are likely to have an impact in the level of IS/IT success, this impact is subtle and does not seem to affect the variables associated with IS/IT success but rather their values and relationships. For example, the national culture and the local economic environment may influence issues like users' attitudes towards IS/IT use. However, what is likely to be different is the "type of attitudes" and their relationships to other factors (such as, for example, CEO support). The factor "user attitudes" had already been identified in previous empirical research. This means that, although the factors identified are likely to be similar to those suggested in the literature, and extracted from studies in other Western contexts, some of the relationships amongst factors, presented in the initial propositions in tables 3.2 and 3.3, may be unique to Portugal.

b) Managers in several firms explained that there is lack of good software available in the market for manufacturing. Furthermore, they claimed that IS/IT vendors displayed opportunistic behaviour, just wanted to sell their products, did not care about customer service and after-sales support. In *FIRM G*, attitudes of resistance to change were identified in the enterprise. The top manager compared the attitudes of the users with a previous experience he had in another European country, stating that this situation would not happen there. However, this research does not intend to study and extrapolate the characteristics of the Portuguese culture that affect IS/IT, neither does an extensive analysis of the Portuguese manufacturing industry. Lack of trust in IS/IT consultants and vendors, and the low quality of the manufacturing software available in the market, as assessed by interviewees, seem to constitute characteristics of the Portuguese manufacturing industry. It is unclear whether or not similar findings can be found in other contexts. In absence of similar research in other environments these findings cannot be compared cross-culturally.

c) The statements provided by the managers interviewed were consistent with the findings reported in previous empirical research. Most of the factors identified in this



research as related to IS/IT success had already been presented elsewhere in the literature (see table 3.1). However, some issues that may be specific to the Portuguese manufacturing industry were found, as described in *b)*, and some factors in the literature did not seem to be relevant, such as the characteristics of the organisational structure. However, further research is still needed in order to understand the subject.

d) In the initial fieldwork, the firms approached were not selected on the basis of their expected level of satisfaction with IS/IT, nor on the level of sophistication of their IS/IT solutions. The major criteria for selecting those enterprises was accessibility. These firms are traditionally open to academic research and also co-operated in another research project. Although all these firms operate in the clothing and textile industries, that was not seen as a significant problem. The factors related to IS/IT adoption and success identified in the literature review do not seem to be strongly dependent on the type of industry where the enterprise operates. Nevertheless, some of the industries involved in the case study research phase (described in chapter 5) have significant similarities, like the clothing and the footwear industries. The manufacturing SMEs in these industries have similar types of customers and manufacturing processes, and they both depend on fashion. It was found in the major case studies that several firms, although operating in different industries, use a similar type of hardware and software for their administrative and manufacturing proposes. For example, three of firms analysed (two footwear manufacturers and one wine producer) use a similar software for manufacturing management. This software was developed by the same supplier, based on the same source code, with adaptations to fit the requirements of each enterprise. However, there are also some differences due to the industry and for example CAD/CAM systems are critical for the mould manufacturers and are not used by wine producers. Therefore, the case studies later selected cover several manufacturing industries with expected different levels of IS/IT adoption and use.

In summary, most of the SMEs in the initial fieldwork showed very low levels of satisfaction with IS/IT adoption and use and generally confirmed the factors identified in the literature as related to IS/IT success. This increased the need to select a set of firms for major case study research that could be expected to constitute examples of success with IS/IT adoption and use.

e) The initial fieldwork, as well as the literature review of previous empirical research, contributed significantly to build a *check-list* for the major case study research and a framework for data analysis. However, the framework for data analysis was later slightly adjusted while analysing the data collected in the case studies. For example, the *political dimension* in the external context that was supposed to analyse the impact of government support was discharged. Government support is mainly conducted through financial aid. Therefore it started to be considered as a source of *financial resources*.



f) The initial fieldwork also served the purpose of enabling the researcher to exercise and test his interview skills and find an appropriate sequence of questions to conduct further interviews in the major case study research phase.

## **Chapter 4**

### **Philosophical Perspective and Research Strategy**

#### **4.1 - Introduction**

The primary goal of the social sciences is to produce a reliable body of knowledge that enables us to explain, predict and understand the social world (Frankfort-Nachmias and Nachmias, 1992). This chapter presents the research strategy adopted, the inherent philosophical perspective, and research design. The identification of a philosophical perspective is important in the sense that it exposes the researcher's assumptions about the nature of the phenomena under investigation (ontology) and his/her point of view of the ways in which is possible to acquire knowledge (epistemology). There is also a strong relation between the adopted philosophical perspective and the definition of a research strategy. Research methods are not self-valid, they depend on epistemological justifications. As Guba and Lincoln (1994) affirm, the selection of a method is secondary to the adoption of a philosophical paradigm. The concept of paradigm is here understood as the researcher's view of the world that guides and defines his/her investigation.

Each research strategy may have specific advantages and disadvantages, according to the type of research question, the control the researcher has over the research object, and the focus on contemporary or historical phenomena (Yin, 1994). This research is rooted in a realist perspective of science, as proposed by Bhaskar (1989a) (critical realism), and the adopted research strategy is based on the use of multiple case studies.

This chapter is structured into four major sections. The first one explains the inherent philosophical perspective; the second section presents the adopted research strategy; the third section identifies the proposed research design; and the fourth section explores the strategy for data analysis.

#### **4.2 - Philosophical perspective**

Each philosophical perspective has its own ontological and epistemological claims and proposes a particular approach, or set of approaches, to social enquiry. Therefore, a basic overview of the main philosophical perspectives is important in order to understand the assumptions of the researcher and justify the selected research strategy.

Hughes (1991) states that positivism and interpretivism are the dominant philosophical perspectives in the history of social sciences. Both these perspectives are also frequently



adopted in IS research (for example see: Walsham, 1993). Therefore, their major issues and viewpoints will be briefly introduced and discussed. Despite the proliferation of interrelated philosophies in social enquiry, it may be suggested that positivism and interpretivism are located in opposite corners and are essential to understand other ontological and epistemological claims. The realist perspective, adopted in this study, is also examined and its main characteristics and differences are analysed.

#### **4.2.1 - Positivism**

Positivism has a long tradition in the history of natural sciences. Positivist science has been historically pursued by well-known philosophers and scientists like Locke, Decartes, Galileo or Comte. Comte attempted to establish the study of society as a scientific discipline, capable of exactness and prediction in a similar way to the natural sciences. Philosophically based on the work of Bertrand Russell and Ludwig Wittgenstein, logical positivism emerged in the early twenties as a doctrine claiming that the only meaningful propositions are those that can be verified empirically. According to logical positivism, systems of logic and mathematics are essentially true by virtue of their logical forms and can be derived from axioms, while any other claim to knowledge is seen as synthetic and can be counterfactually shown to be false (Giddens, 1976). Logical positivism has a strong influence in both natural and social science research. According to Hirschheim (1992: p.51), logical positivism “is commonly considered to be the dominant epistemology of contemporary science. Although it has evolved over the past sixty years, it is still firmly rooted in the positivist camp”

Positivism can be primarily synthesised through the assumption that the social world really exists and that its characteristics can be measured through objective methods, rather than being mentally constructed or subjectively appreciated through reflection and intuition (interpretivism). Its epistemology seeks to explain and predict what happens in the social world by looking for regularities and causal relationships between its elements (Burrell and Morgan, 1979).

Hirschheim (1992) considers that positivism has a five point doctrine:

- The unity of the scientific method - which means that the accepted approach for knowledge acquisition is valid for any form of inquiry and any research domain (physical, non-physical, human, animal, etc.);
- The aim to find regularities and causal relationships among the elements of the study;
- The conviction that only experience can provide valid data;
- The assumption that science and its processes are value-free. Science transcends all cultural and social beliefs held by the scientist;



- The belief that logic and, more generally, mathematics provide the foundations of science. They provide a universal language and a formal basis for quantitative analysis.

It is a common belief that experimentation and observation, correctly applied, can eradicate the influence of social and cultural values and, therefore, build up an image of reality independent from the observer. The aim of social enquiry is the identification of causal explanations and fundamental laws that explain regularities in social behaviour. Within the positivist tradition, “science proceeds through a process of hypothesising fundamental laws and then deducting what kinds of observations will demonstrate the truth or falsity of these hypotheses” (Easterby-Smith *et al.*, 1991: p.23). For the positivist, science embodies a set of universal statements, whose truth or falsity can be analysed and evaluated by systematic observation and experience. Moreover, science is seen as an attempt to predict and explain the external world by identifying regularities through observation and rejecting any scientific concepts that go beyond the domain of the observable.

Positivism explains human behaviour in terms of cause and effect. Social and natural phenomena can be explained in the same way. Research in the social sciences must be conducted with the same state of mind as a physicist or biologist when investigating an unknown scientific domain of the natural sciences. The researcher must be independent from the research subject and the investigation is supposed to produce a set of true and precise laws of human behaviour. As Hirschheim (1992: p.51) states: “the purpose of scientific inquiry is to rationalise reality”.

#### **4.2.2 - Interpretivism**

An interpretivist perspective of science considers that the social world is essentially relativistic and can only be understood by interpreting the activities which are to be studied. Interpretive methods of research assume that our knowledge of reality is a social construction by human actors and researchers, and thus subjective. In contrast to the assumptions of positivism, interpretive ontology sustains that “there is no objective reality which can be discovered by researchers and replicated by others” (Walsham, 1993: p.5).

From an interpretivist point of view, there are significant differences between the research object of the natural and the social sciences. The study of natural phenomena requires the scientist to invent concepts and theories in order to describe and explain nature. By using those theories, the natural scientist decides about what is appropriate to the problem under investigation. On the other hand, the study of social phenomena requires an understanding of the social world that people produce and reproduce through their continuing activities. Since people are constantly involved in interpreting their world (social situations and behaviour), they develop meanings for their activities and



ideas about what is relevant for making sense of those activities (Blaikie, 1993). Interpretive approaches adopt the philosophical position that knowledge is a social construction and that theories concerning reality provide ways of viewing and understanding the world rather than discoveries about the world representing absolute truth. From this viewpoint, there are no correct or incorrect theories but more and less interesting ways to see the world (Walsham, 1993). Blaikie synthesises the underlying purpose of an interpretive approach to social enquiry by saying that:

*...the major task of interpretive social science is to discover why people do what they do by uncovering the largely tacit, mutual knowledge, the symbolic meanings, intentions and rules, which provide the orientations for their actions. (Blaikie, 1993: p.176)*

Interpretivism has its roots in *hermeneutics* and *phenomenology*. Hermeneutics is basically concerned with interpreting and giving meaning to texts. For example, Boland (1985) argues that the use, design and study of Information Systems can be seen and understood as an hermeneutic process, since the output of an IS is a text that must be interpreted by people other than the author. Phenomenology is deeply rooted in the work of Husserl and Schütz and views *phenomena* as objects of perception rather than facts or things that exist independently of the observer. Phenomenology focuses on the ways in which people think and interpret the world around them and views reality as relative and subjective. The world is socially constructed and the observer is part of what is observed.

#### 4.2.3 - Realism

Realism is a relatively recently emerging philosophical perspective, with its own ontology and epistemology. As Blaikie (1993: p.59) explains: “while sharing positivism’s desire for producing casual explanations and interpretivism’s views on the nature of social reality, realism argues for a view of science that is different from either of these approaches.”

A realist approach to social enquiry is essentially described in the work of philosophers like Keat and Urry (1975), Harré (1986) and Bhaskar (1978, 1986, 1989a and 1989b). Bhaskar’s (1989a) concept of *critical realism* emerged by linking his general philosophy of science (transcendental realism) with his philosophy of the human sciences (critical naturalism). Bhaskar (1978; p.250) clarifies the ontology of realism by saying that “things exist and act independently of our descriptions, but we can only know them under particular descriptions”. In other words, science is seen as a systematic attempt to express in thought the structures and ways of acting of things that exist independently of thought (Bhaskar, 1978). According to realism, the ultimate objects of scientific inquiry exist and act independently of scientists and their activity and science is essentially concerned with what kind of things exist and how they



behave. Bhaskar explains the role of a realist philosophical perspective in guiding social research by saying that:

*Realism is not, nor does it licence, either a set of substantive analyses or a set of practical policies. Rather, it provides a set of perspectives on society (and nature) and how to understand them. It is not a substitute for, but rather helps to guide, empirically controlled investigations into the structures generating social phenomena. (Bhaskar, 1989a: p.3)*

Analysing the realist perspective from an ontological point of view, Burrell and Morgan (1979) state that realism “postulates that the social world external to individual cognition is a real world made up of hard, tangible and relatively immutable structures”. Outhwaite (1987: p.19) explains that “realism is a common-sense ontology, in the sense that it takes seriously the existence of things, structures and mechanisms revealed by the sciences at different levels of reality”.

Bhaskar (1978) identifies three domains of reality to classify experiences, events and mechanisms: the empirical, the actual, and the real. The empirical is made up of experience, of events that can be observed. The actual is composed of events, whether or not they are observed. The domain of the real consists of structures and mechanisms which produce these events. All these domains are interdependent. The empirical is a subset of the actual, which is itself a subset of the real. Consequently, realism is grounded in the assumption that the conceptual and the empirical do not exhaust the real. Bhaskar (1989a) carefully distinguishes between the human descriptions of reality and the reality that the researcher pretends to describe. Within this philosophical perspective, experiments can be seen as closed systems constructed by humans to test their theories, while causes must be seen as tendencies that may, or may not, react with other tendencies to produce effects (William and May, 1996: p.83).

Critical realism, as described by Bhaskar (1989a), aspires to explain the relationship between human activity and social structures. As the author says, “the existence of social structure is a necessary condition for any human activity” (Bhaskar, 1989a: p.3). Social phenomena are perceived as a result of a multiplicity of structures, which cannot be directly perceived, but may be inferred and identified through the examination of their effects.

From an epistemological perspective, realism is “methodologically open”, in the sense that does not define a method. Realism “is concerned with developing methods appropriate to the particular subject matter of the social sciences” (Blaikie, 1993: p.58). While accepting that the social world is real and exists, a realist perspective of the social sciences also accepts the interpretive view that society is both produced and reproduced by its members, who may have different perceptions and interpretations about the same reality. As Layder (1993: p.16) explains, “a central feature of realism is its attempt to



preserve a “scientific” attitude towards social analysis at the same time as recognizing the importance of actors' meaning and in some way incorporating them in research”.

May (1993) exposes the main assumptions of realism:

*Realism argues that the knowledge people have of their social world affects their behaviour and, unlike the propositions of positivism and empiricism, the social world does not simply exist independently of this knowledge. However, people's knowledge may be partial or incomplete. The task of social research is not simply to collect observations on the social world, but to explain these within theoretical frameworks which examine the underlying mechanisms which structure people's actions and prevent their choices from reaching fruition,...* (May, 1993: p.7)

Based on the work of Bhaskar, Outhwaite (1987: p.45) presents a summary of the ontological principles of realism:

- The distinction between transitive and intransitive objects of science: between concepts, models, etc. and the real entities and relations which make up the natural and the social world.
- A stratification of reality into the domains of the real, the actual and the empirical.
- The conception of causal relations as tendencies, grounded in the interactions of generative mechanisms; these interactions may or may not produce events which in turn may or may not be observed.
- The rejection of both empiricism and conventionalism. The practical expression of this epistemological position is the concept of real definition. Real definitions are statements about the basic nature of some entity or structure.
- The concept of explanation involves the postulation of explanatory mechanisms and the attempt to demonstrate their existence.

Several criticisms have been made, from a realist standpoint, to the positivist and interpretive views of the world. Tsoukas (1989) criticises the positivist perspective of science by arguing that:

*If positivistic claims about the natural and social sciences were true, scientific activity would not have been possible because most events in the natural and the social world take place in open systems, in which events do not invariably follow a determined and recurrent patterns; ... instead they are subject to diverse causal variations. Precisely because of the open character of the world, scientists need to engage in experiments in which the conditions for constant conjunctions of events (i.e. closed systems) need to be constructed so that causal laws can be identified.* (Tsoukas, 1989: p.552)

The scientist in experimental activities does not produce the causal laws he/she identifies, instead the scientist should be seen as an agent of patterns of events, generated under conditions of closure, through which he/she gains access with the aim of identifying causal laws. In the social sciences, the impossibility to construct a closed environment for research leads to the development of theories that should be essentially seen as explanatory by nature and not predictive because, as Tsoukas (1989: p.552)



argues, “explanation and prediction are symmetrical only under conditions of closure”. Looking at the field of information systems, Galliers and Land (1987: p.900) present a similar perspective by stating that “there are only a limited number of factors that can be studied under laboratory conditions, and it is difficult to reproduce a “real world” environment in these circumstances”. Furthermore, Klein and Lyytinen (1985: p.131), discussing the different philosophical approaches used in IS research, hold that “IS will remain a dubious science as long as it tries to emulate the so-called scientific method as the only ideal of academic enquiry”.

Unlike positivism, a realist perspective of the social sciences does not assume that we can know the “world out there”. This philosophical perspective is located between the positivist assumption that there is a “world out there” independent of our interpretations and the interpretive view that reality is a mental construction. Realists defend that the “world out there” exists, but it may not be possible to perceive its essence, so the aim of realist research is a search for generative mechanisms instead of predictive theories.

*Realists argue for an understanding of the relationship between social structures and human agency that is based on a transformational conception of social activity, and which avoids both voluntarism and reification... We do not create society - the error of voluntarism. But these structures which pre-exist us are only reproduced or transformed in our everyday activities; thus society does not exist independently of human agency - the error of reification. The social world is reproduced or transformed in daily life. (Bhaskar, 1989a: p.3-4)*

Realists believe that one cannot achieve a complete and ultimate knowledge of the “world out there”, although (contrary to the interpretive perspective) there is evidence that reality exists. In the social sciences, “scientific truth” may be impossible to reach but it seems possible to identify mechanisms and potential explanations that rule social behaviour.

Layder (1993: p.16), approaching the question of how a realist view of social sciences affects the practice of social research and the formulation of a strategy and method, states that “a central feature of realism is its attempt to preserve a scientific attitude towards social analysis at the same time as recognising the importance of actors’ meaning and in some way incorporating them in research”. Since they have different roles and are located in different positions, the key actors in the process of IS/IT adoption and use in SMEs may have distinct views about the same reality. Hence, the combination of those different perspectives is likely to provide a more in-depth understanding of the problem under investigation and the underlying mechanisms that are related to the process of IS/IT adoption and use.

In the light of a realist perspective, Whitley states that “there are no epistemological barriers to management research being scientific in the sense of gaining knowledge of invariant causal mechanisms which operate as tendencies in open systems” (Whitley,



1984: p.387). In management studies the objective of the research may be essentially explanatory:

*...research goals and orientation may be primarily intellectual and explanatory so that the main concern is to understand and explain managerial practices and activities as part of more general phenomena such as changing patterns of the organisation and control of work in highly differentiated societies. The basic focus here is to provide better explanations of theoretically significant phenomena - however this is understood - in order to gain high reputations from intellectual colleges for one's contribution to collective goals ... Secondly, research goals and orientation may be primarily practical in the sense of contributing to the change and improvement of present practices.*  
(Whitley, 1984: p.372)

### **4.3 - Research strategy**

#### **4.3.1 - Selecting a research strategy**

Every research strategy has its strengths and weaknesses. Therefore a research strategy must be selected according to the object of study, research objectives and researcher's philosophical perspective. According to Hamilton and Ives (1992: p.143), "the key to good research, though, is not just in choosing the right research strategy, but in asking the right questions and picking the most powerful method(s) for answering the questions given the objectives, research setting and other salient factors".

Information Systems research has been dominated by three main research strategies: laboratory experimentation, survey and case study (Farhoomand, 1992; Orlikowski and Baroudi, 1991). The evolution of this relatively new area of knowledge (IS/IT), from an early focus on the technology to a stronger emphasis on social issues, led to the shift from a more positivist perspective of research to the use of interpretive approaches. Galliers (1992: p.162) stresses that "information systems researchers are becoming aware of the limitations of the scientific approaches to their work, given the socio-technical nature of their chosen field of endeavour".

Action research is another post-positivist social research method, frequently applied in the field of information systems (Baskerville and Wood-Harper, 1996; Stowell *et al.*, 1997). This method can be seen and understood as an interactive action of "acquisition of process knowledge concerning problem solving" (Checkland and Scholes, 1990: p.182). It is usually developed through five cyclical phases: diagnosing, action planning, action taking, evaluating and specifying learning (Susman and Evered, 1978). Within this approach, the researcher is not a mere detached observer, he is an active participant in the object of the research. According to Baskerville and Wood-Harper (1996), the method is simultaneously empirical and interpretive, experimental and multivariate, observational and interventionist, and adequate to the study of technology in its human



context. Although action research has been shown to be a valuable approach to social enquiry, this method was not the most appropriate for the study. The researcher was interested in comparing several firms with different levels of IS/IT adoption and success, and the number of cases for analysis would have to be significant to achieve this objective. The analysis of several case studies based on the use of action research would have been a very complex and demanding task. Moreover, obtaining sufficient and appropriate access over time for action research would have been difficult, especially in the context of SMEs.

The selected research strategy for this study is based on the use of multiple case studies. Case studies have increasingly been used in the field of Information Systems. Hamilton and Ives, analysing information systems research published in fifteen academic journals, found that “case studies are the most commonly employed empirical strategy” (Hamilton and Ives, 1992: p.142). Compared with surveys, case studies provide a deeper understanding of the research subject. Yin (1994: p.13) argues that a case study is an “empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomena and the context are not clearly evident”. Traditional positivist research, based on surveys, tends to look at context either “as a set of interfering variables that need controlling, known as noise in the data, or other controlled variables which are experimentally set up in order to seek for cause and effect relationships” (Myers, 1997: p.244).

The validity of case study research is not affected by the argument, pointed out by Pratten (1991), that managers of enterprises with problems tend not to allocate time to participating in survey research. Case studies are not supposed to be a statistically valid sample of the population, and one or two cases may be enough to conduct the research and reach valid conclusion. Nevertheless, as was confirmed in this research, it is likely to be easier to get access to enterprises that can be classified as “cases of success” than to the enterprises that were “unsuccessful”. This is because, in the latter, managers may avoid displaying a negative image of the organisation.

In the field of Information Systems, Benbasat *et al.* (1987) stress the idea that “case research is particularly appropriate for certain types of problems: those in which research and theory are at their early, formative stages” (p.369). Moreover, these researchers argue that multiple case studies are desirable whenever the aim of the research is description, theory building or theory testing.

According to Yin (1994), *how* and *why* questions are more appropriate to the use of case studies. *How* questions are usually associated with describing relationships (previously identified by answering *what* questions), while the so-called *why* questions tend to explain the reasons why those relationships exist (Whetten, 1989; Yin, 1994). As Yin (1994) stresses, case studies are appropriate when the nature of the study is to understand a previously unresearched subject.



Although different research strategies and methods have been previously used in this research area (IS/IT in SMEs), for example, grounded theory (Wroe, 1986), longitudinal studies (Cragg and King, 1993) and case study research (Naylor and Williams, 1994), most of previous research has been done, from a positivist perspective, through the use of structured survey questionnaires for data collection (Chen and Williams, 1993; Cragg, 1990; DeLone, 1983 and 1988; Kagan *et al.*, 1990; Lees, 1987; Lefebvre and Lefebvre, 1988; Montazemi, 1987 and 1988; Nickell and Seado, 1986; Olaisen, 1991; Raymond, 1985, 1987, 1988 and 1989; Yap *et al.*, 1992).

Several factors are likely to explain the lack of case study research in the subject of IS/IT in SMEs. First, in contrast to large firms, most small firms do not have extensive use of IS/IT and may not be seen as interesting for in-depth case study. Second, in SMEs, managerial decisions are usually concentrated on the owner/CEO, who may have little time available to co-operate in in-depth case study research. Third, due to the small size of an SME, the presence of the researcher, while collecting data, is easily noticed in the organisation and may affect its normal behaviour. Fourth, the competitiveness of many SMEs is usually based on a specific know-how, sometimes not difficult to copy, which might make firms reluctant to share information that is vital for their survival even if confidentiality is assured by the researcher.

SMEs are increasingly using IS/IT. The expectations about IS/IT effectiveness and strategic impact in SMEs led to the need of a deeper understanding of the process of IS/IT adoption. Surveys using highly structured questionnaires are regarded as easily replicable and reliable but their weakness is a relative lack of naturalism (Gill and Johnson, 1991). Furthermore, surveys have a specific scope of action. This means that they tend not to be the most suitable research method to provide a deep understanding of the nature of the process of IS/IT adoption and use in SMEs. Consequently, in the literature, there exists a significant lack of research oriented to understanding how the different factors, related to the context, process and content, affect IS/IT adoption and use in SMEs. However, as William and May (1996) state, to talk about causes and effects without identifying the underlying mechanisms is to elaborate a fiction.

In this study, the research strategy will be based on a multiple case study approach. The research questions are explanatory by nature and the use of in-depth case studies, based on semi-structured interviews, seems to be the most appropriate research method. Through the use of case studies it is possible “to ask penetrating questions and to capture the richness of organisational behaviour” (Gable, 1994: p.113) and provide more complete explanations about the researched phenomena. Additionally, Mason (1996: p.148) explains that “most qualitative researchers see the very fluidity and flexibility of methods such as semi-structured interviewing as enhancing validity, and criticise the rigidity and standardisation of structured questionnaires by contrast for lack of



sensitivity to validity in favour of an excessive concern with reliability and ease of qualification in analysis”.

#### **4.3.2 - The positivist and interpretive approaches to case study research**

Lacity and Jason (1994: p.152) explain that the two reasons for the discrepancy between interest in and adoption of qualitative approaches may be that “researchers are unfamiliar with qualitative methods and they may mistake “qualitative” research for “nonpositivist” research”. Although, traditionally, case studies have not always been accepted as a research method in the logical positivist tradition, Yin’s (1993, 1994) approach to case study research is a positivist approach. As the author declares: “the approach here has been to base case study research within the framework of the scientific method - to develop hypotheses, collect empirical data, and develop conclusions based on the analysis of such data” (Yin, 1993: p.47). Case study research may be used to “emulate” positivism, although it does not provide the traditional statistical generalisation that positivists usually look for. Instead, case studies, within the positivist school of thought, provide analytical generalisations:

*...case studies, like experiments, are generalisable to theoretical propositions and not to populations or universes. In this sense, the case study, like the experiment does not represent a “sample”, and the investigator’s goal is to expand and generalise theories (analytical generalisation) and not to enumerate frequencies (statistical generalisation). (Yin, 1994: p.10)*

Yin (1994) also explains that in analytic generalisation “a previously developed theory is used as a template with which to compare the empirical results of the case study. If two or more case studies are shown to support the same theory, replication may be claimed.” (p.31)

According to Yin (1994), the criteria for judging the quality of case study design is essentially based on four major concepts: construct validity (defining the appropriate operational measures for the concepts being studied); internal validity (establishment of correct relationships between patterns); external validity (possibility of replication and generalisation); and reliability (proper execution of the procedures, so that another researcher would obtain similar results). Triangulation is usually seen as an important mechanism for validating data. Data triangulation is accomplished by analysing if the data obtained from different sources of evidence (interviews, documents or observation) are consistent in pointing in the same direction.

Case studies have also been related to an interpretive perspective of social research. Some research previously conducted in the field of information systems is grounded in the interpretive perspective of the social sciences (for example: Dhillon, 1995; Symons, 1990; Walsham, 1993). Following a postmodernist Anglo-American perspective, rooted in a constructivist approach to information systems research, some researchers, like



Crowe *et al.* (1996: p.13), accept that “validity should be expressed in terms of usefulness rather than truth”.

Since interpretive research methods start from the philosophical position that our knowledge is a social construction, case studies are designed to understand or explain a specific subject, by capturing the different perspectives and views of the *actors* involved in the process or context being analysed. Therefore, the use of validating techniques like triangulation must be used in a way different from a positivist approach, because interpretive researchers sustain the view that multiple perspectives of the same facts and events may coexist. These perspectives must be equally represented and “there is no way to establish, beyond contention, the best view” (Stake, 1994: p.108).

Walsham (1993) argues that theories which researchers present are interesting to themselves and may, or may not, be interesting to others. The quality of interpretive research, Walsham (1993) explains, is evaluated by the criterion of intersubjectivity:

*...the use by an individual author of a particular theoretical approach derives no doubt from his or her personal experience and insight, the testing of the value of these insights to others can be carried out by exposing the approach through verbal and written discourse to enable broader judgements to be made. Theory can be compared evaluated and improved by this form of public testing; the result is not the generation of ‘best’ theory, but the creation of intersubjectively tested theoretical approaches, considered of value to a broader group than a single individual. (Walsham, 1993: p.6)*

#### **4.3.3 - A realist perspective of case study research**

Bhaskar’s (1986, 1989a) theory of critical realism is an interesting philosophical perspective for case study research. Critical realism can be used in the social sciences, in particular in management research, and is capable of solving many of the problems related to representational claims, theoretical focus and explanatory status (Porter, 1993). As Porter (1993) states, “the aim is not to describe events, but to explain why they occur” (p.591). Research conducted within a realist perspective of science focuses on understanding the mechanisms and structures that rule social behaviour. The primary problem of realism is how to establish the plausibility of hypothesised structures and mechanisms considering that they are not immediately available to experience (Harré, 1979). As Blaikie (1993: p.163) explains, “a critical issue for realism is how to arrive at the postulated structures and mechanisms,..., how to derive theories from everyday activities and meanings“. Harré (1976) states that, in realist research, the creative task is to invent a plausible analogue of the mechanism which is really producing the phenomenon.

Bhaskar (1979) suggests a “retroductive” strategy to research that is summarised in Blaikie (1993):



1. In order to explain observable phenomena, and the regularities that exist between them, scientists must attempt to discover appropriate structures and mechanisms.
2. Since these structures and mechanisms will typically be unavailable to observation, we first construct a model of them, often drawing upon already familiar sources.
3. The model is such that, were it to represent correctly these structures and mechanisms, the phenomena would then be causally explained.
4. We then proceed to test the model as a hypothetical description of actually existing entities and their relations.
5. If these tests are successful, this gives good reason to believe in the existence of these structures and mechanisms.
6. It may be possible to obtain more direct confirmation of these existential claims by the development and use of suitable instruments.
7. The whole process of model-building may then be repeated, in order to explain the structures and mechanisms already discovered.

Harré (1976) argues that a significant difference between the natural and the social sciences is that, in the natural sciences, scientists create models based on the existing world, while in the social sciences, social actors create the world based on models that represent their individual perceptions. The social scientist creates models as a surrogate for generative mechanisms.

Layder (1993) proposes a new strategy for social research, based on a realist perspective of social enquiry. Layder's work has been frequently pointed out as the most comprehensive approach to social research within the realism perspective. As Vaitkus (1994, p.76) comments, "Derek Layder delivers in this book a splendid and strongly thought-out contribution to the Anglo-Saxon tradition of clear categorisation and positioning of philosophical Ansätzen and perspectives for sociology and its empirical research".

The research strategy is developed by discussing and criticising two well-established approaches: Merton's middle-range theory (Merton, 1968) and grounded theory (Glaser and Strauss, 1967; further developed in Strauss and Corbin, 1990). Middle-range theory is a positivist type of approach that considers that the social researcher should follow, as far as possible, the research model of the natural sciences. On the other hand, grounded theory is characterised by generating theory directly from data obtained in qualitative research, without any previous preconceived theoretical ideas about the topic being researched. Therefore, it is argued that a more close relationship between theory and data would be achieved. Glaser and Strauss (1967) hold that qualitative methods and data are the only way to capture the nature of the processes, interpretations and meanings studied by the social researcher. Participant observation, semi-structured interviews and documentary materials are equally valid accepted research instruments.



Layder (1993: p.197) criticises middle-range theory as drawing on a “rather inappropriate and rigid notion of science on which it rests”. According to Layder (1993), neither middle-range theory nor grounded theory cover certain important issues in social research, “the macro-micro problem (and the associated problem of institutional versus interpretive analysis), the stratified nature of social life, the analysis of power, the historical dimension, and last but not least, the relation between general theory and research theory” (Layder, 1993: p.198). Layder (1993) stresses that a key aspect of realism is “a concern with the identification of causal mechanisms in social phenomena in a manner quite unlike the traditional positivist search for causal generalisations” (Layder, 1993: p.198).

The research strategy proposed by Layder (1993) includes the following key features:

1. An initial focus on the research topic using a research map (presented in figure 4.1);
2. The use of a multistrategy research;
3. The development of structural typologies;
4. An examination of the dimensions: power, commitment and constraint.
5. An historical analysis.

The central purpose of the research map is to help in the formulation of initial ideas about social research with the primary aim of generating theory. The map intends to present the different levels and dimensions of social reality: the self, situated activity, setting, context and history (see figure 4.1). It enables the researcher to approach the problem of the links between the different levels of social reality, which is not covered by traditional approaches, like middle-range theory or grounded theory. Moreover, the *research map* allows the researcher to be sensitive to different units and time scales that are involved in social processes.

HISTORY	CONTEXT	<i>Macro social organisation</i> Values, traditions, forms of social and economic organisation and power relations. (ex: class, gender, ethnic relations)
	SETTING	<i>Intermediate social organisation</i> Intermediate environment of social activity (ex: factory, schools, ...)
	SITUATED ACTIVITY	<i>Social activity.</i> Face-to-face activity involving symbolic communications by skilled, intentional participants implicated in the above contexts and settings. Focus on emergent meanings, understandings and definitions of the situation as these affect and are affected by context and settings (above) and subjective dispositions of individuals (below).
	SELF	<i>Self-identity and individuals social experience</i> As these are influenced by the above sectors and as they interact with the unique psychobiography of the individual. (ex: focus on life-career).

Figure 4.1 - Research map

Source: Adapted from Layder, 1993: p.72.

Multistrategy research is suggested in order to achieve a deep empirical and theoretical coverage of the research subject. The methods, data sources and research strategy should be selected using the following criteria: the nature of the research; the fitness of the methods to answer the research questions; the availability and accessibility of data; and the resources at the researcher disposal (such as, time, equipment, etc.). In realist research both qualitative and quantitative data can be used (Layder, 1993; Mingers, 1997a and 1997b). The multistrategy approach, proposed by Layder, encourages the use of quantitative data in order to complement the core of qualitative analysis. Methodological and analytical cuts into data are suggested in order to prepare the researcher to respond to hidden aspects and problems of the research. Furthermore, these cuts increase the possibility of producing grounded theory, which is considered by Layder (1993) as methodologically robust.

The development of structural typologies, which concentrate on the nature of the settings and context of activity, are assumed by Layder as important means of generating theoretical and empirical descriptions of social phenomena. A similar viewpoint is found in Doty and Glick (1994), who see typologies as a unique form of theory building. These academics criticise the way typologies are traditionally viewed - as classification systems rather than theories. Instead, they argue that "typologies are complex theories that are frequently misinterpreted" (p.231). According to Doty and Glick (1994), a theory is usually perceived as "a series of logical arguments that specifies a set of relationships among concepts, constructs, or variables" (p.232). Thus, to fit this definition, a good typological theory should: make explicit theoretical



assertions; completely define the set of ideal types; provide a complete description of each ideal type using the same set of dimensions; state the assumptions about theoretical importance of each construct used to describe the ideal types; and be tested with conceptual and analytical models that are consistent with the theory.

Layder (1993) argues that a realist approach to fieldwork should try to find aspects of power in the data. Moreover, he stresses that some forms of power and domination lie very much "behind the scenes" of the every day activities and interpersonal behaviour. Hence, the researcher must understand how these forms of power operate and how they may influence relationships and organisational behaviour. In a similar way, the notion of commitment also reflects the dual nature of social activity. An historical analysis is considered important in social research. The historical dimension can give an indication of organisational development and how this development is likely to affect the interpersonal relations and justify the present situation.

Following a realist perspective, Mingers *et al.* go a step further in suggesting the adoption of a multiparadigm (Mingers 1997a and 1997b; Mingers and Brocklesby, 1997), in line with previous work done by Lee (1991). According to Mingers, a realist approach may be able to combine several research methods, across different paradigms:

*... all problem situations are complex and multi-dimensional, involving material, social and personal aspects. An intervention should therefore be more effective if it addresses, within the limitations of time and resources, all these features. This suggests that, wherever possible, a range of methodologies (or parts thereof), across the paradigms, should always be used. (Mingers, 1997b)*

However, a multiparadigm approach will not be followed in this research because the researcher believes that, at an ontological level, different paradigms may not be compatible. Furthermore, it is argued that realism is by itself a unique philosophical perspective, although different research methods can be used and combined. In spite of the interest that it has been raising in the field of information systems (see Walsham, 1995 and Mingers, 1997a), realism is a relatively recent philosophical perspective and little research can be found assuming a realist perspective of social science. With few exceptions, most case studies are either based on the positivist or on the interpretivist paradigms. This strengthens the interest in using this approach for research in the field of information systems.

## 4.4 - Research design

### 4.4.1 – Overall strategy

The research project is structured into several phases. Figure 4.2 presents the major phases and their logical sequence, which will be explained in the following paragraphs.

The literature review had revealed a gap in explaining IS/IT adoption and use in manufacturing SMEs. There is very little research in the area, some is likely to be out-of-date and it does not include Portugal. The lack of research on Portuguese SMEs and the non-existence of up-to-date secondary sources of data on IS/IT adoption and use in Portuguese manufacturing SMEs supported the importance of the preliminary fieldwork. Seven enterprises, in the Portuguese clothing and textile industry, were studied and data were collected through semi-structured interviews with entrepreneurs, senior managers, and IS/IT managers. This preliminary fieldwork contributed to identifying potential firms that fitted the purpose of the research and to develop a framework for data analysis.

A framework, based on the work of Pettigrew *et al.* (1989), was used to classify and critique previous literature and analyse the data from the initial fieldwork. The framework has four dimensions: internal context, external context, process and content. The analysis of the data leads to the argument that, in order to understand the successful adoption and use of IS/IT in manufacturing SMEs, it is necessary to understand relationships between factors across the *internal context*, *external context*, *process* and *content* of IS/IT adoption and use.

IS/IT adoption and use is viewed as a complex process inseparable from its organisational and external context. Using Layder's (1993) research model, this research will concentrate on the link between the *situated activity* and the *setting*, since it analyses the existing competencies, relationships and processes related to IS/IT adoption and use. As suggested by Layder (1993), the history of IS/IT adoption and use in the enterprise will be analysed because it may provide a source of understanding for the current situation.



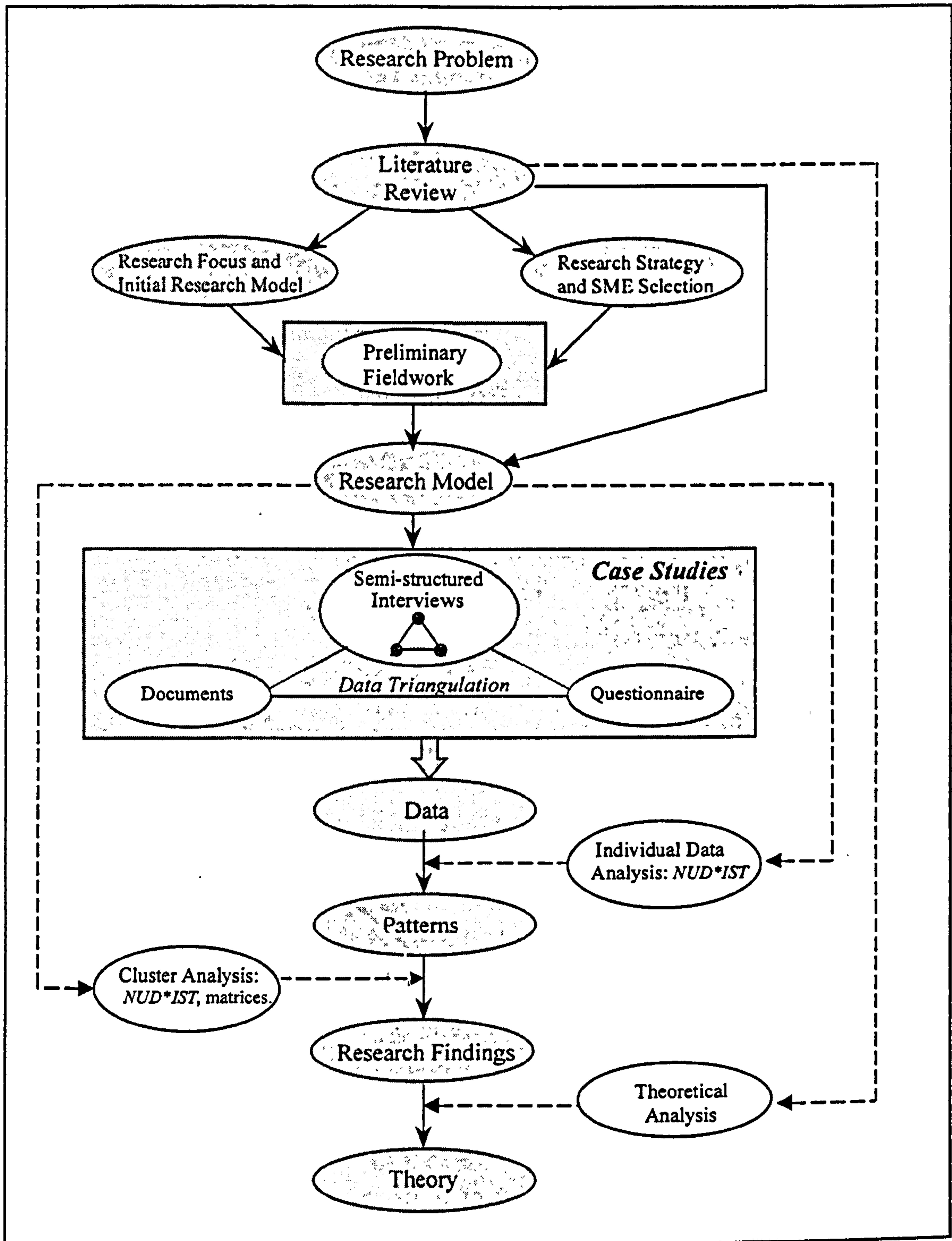


Figure 4.2 - The stages of the research.  
Source: Compiled by the author.

Previous empirical research in the field was essentially conducted through surveys that are inadequate to provide a deep understanding of a complex situation involving a combination of multiple factors, which may cause different levels of adoption and success. The main fieldwork was based on multiple case studies using several sources of data collection. In order to have an ample picture of the situation, the enterprises participating in the fieldwork were sought to cover distinct external contexts and have different levels of IS/IT adoption.

#### **4.4.2 – Case study selection criteria**

The firms chosen were selected across different industries. A set of twelve enterprises in several manufacturing industries (footwear, textiles, clothing, cement pipes, wine and mould industry) was selected for in-depth case study research. For example, in the Portuguese mould industry, higher levels of IS/IT adoption and use are more likely to be found than in the footwear and clothing industries.

In a similar way, it is desirable to analyse SMEs with different levels of user information satisfaction. The matrix in figure 4.3 shows the different combinations of “profiles” that were considered in the selection of a firm for case study research. The twelve cases were aimed to be distributed across the different areas shown in figure 4.3. However, some combinations between levels of IS/IT adoption and assessed relative levels of IS/IT success may not be easy to find.

The enterprises selected for case study research were identified based on interviews and meetings with Portuguese academics, SME managers, and managers in organisations that aimed to promote and support SME’s development (industrial associations and chambers of commerce). Availability of access was also an important factor. Two other firms, apart from the twelve studied, were also contacted but they were too small for the objectives of the research and were discarded after an initial interview. The SMEs selected operate in the Portuguese manufacturing industry, cover different levels of IS/IT adoption and use, and were likely to have different assessed levels of IS/IT success.

The firms involved in the case study research do not represent the general situation of the Portuguese SMEs. The sample was selected on the basis of studying firms that were successful or unsuccessful with IS/IT adoption and use. The sample does not enable any type of statistical generalisation to be made for Portuguese industry.



		<u>Level of IS/IT Adoption</u>			
		Administrative systems only	+ Core manuf. processes	+ Integrated core processes	+ External Integration
<u>Assessed relative level of IS/IT success</u>	Low				
	High				

Figure 4.3 – Case study selection criteria  
Source: Compiled by the author

#### 4.4.3 – Data collection method

Semi-structured interviews were the main research method used. This method of data collection was complemented by an analysis of the documents provided by the firm and a short questionnaire to confirm the level of IS/IT success perceived in the interviews. Semi-structured interviews are able to generate rich data that allow an understanding of the research topic according to the perspectives of the key actors involved (CEOs, owners, IS/IT managers, senior managers, IS/IT experts, IS/IT vendors, IS/IT consultants). As discussed earlier, IS/IT success is analysed through the use of a common surrogate measure of IS/IT success - *user satisfaction*. In this context, *user satisfaction* was defined as interviewees' satisfaction with the performance of IS/IT in the firm.

Between three and five research participants were interviewed individually in each of the twelve firms. All interviews were recorded on tape, except one, because the interviewee did not give consent to the tape recording. Hand notes were also taken on important parts of the interview and some statements were collected through informal conversations. Almost all enterprises provided access to internal documents describing the business activity, the financial situation of the firm, the existing software, and the configuration of the hardware.

#### 4.4.4 - Data analysis method

The interviews were transcribed into Portuguese and translated into English by the researcher, generating a total amount of 345 pages. A Portuguese professor of information systems checked, by sample, the accuracy of the transcription and translation. The translation of the data was carried out following a communicative translation, i.e. adopting a free, idiomatic approach, where the sense of the statements and not the words are considered most important (Baker, 1996). In cases where statements did not translate well, the original expression was kept in Portuguese and English. Since the mother tongue of the researcher is Portuguese, an equivalent translation, as suggested in Brislin (1993), was not conducted because in case of doubt it was always possible to check the original data.

The data in English were coded and analysed by the use of a software package for qualitative data analysis – *NUD\*IST*. The data were input into *NUD\*IST* and each paragraph was coded by factor (a paragraph may contain references to more than one factor). *NUD\*IST* helped to structure the data, according to the dimensions suggested by the research framework. The structure of the framework was introduced in the index system of the software package (see figure 4.4).

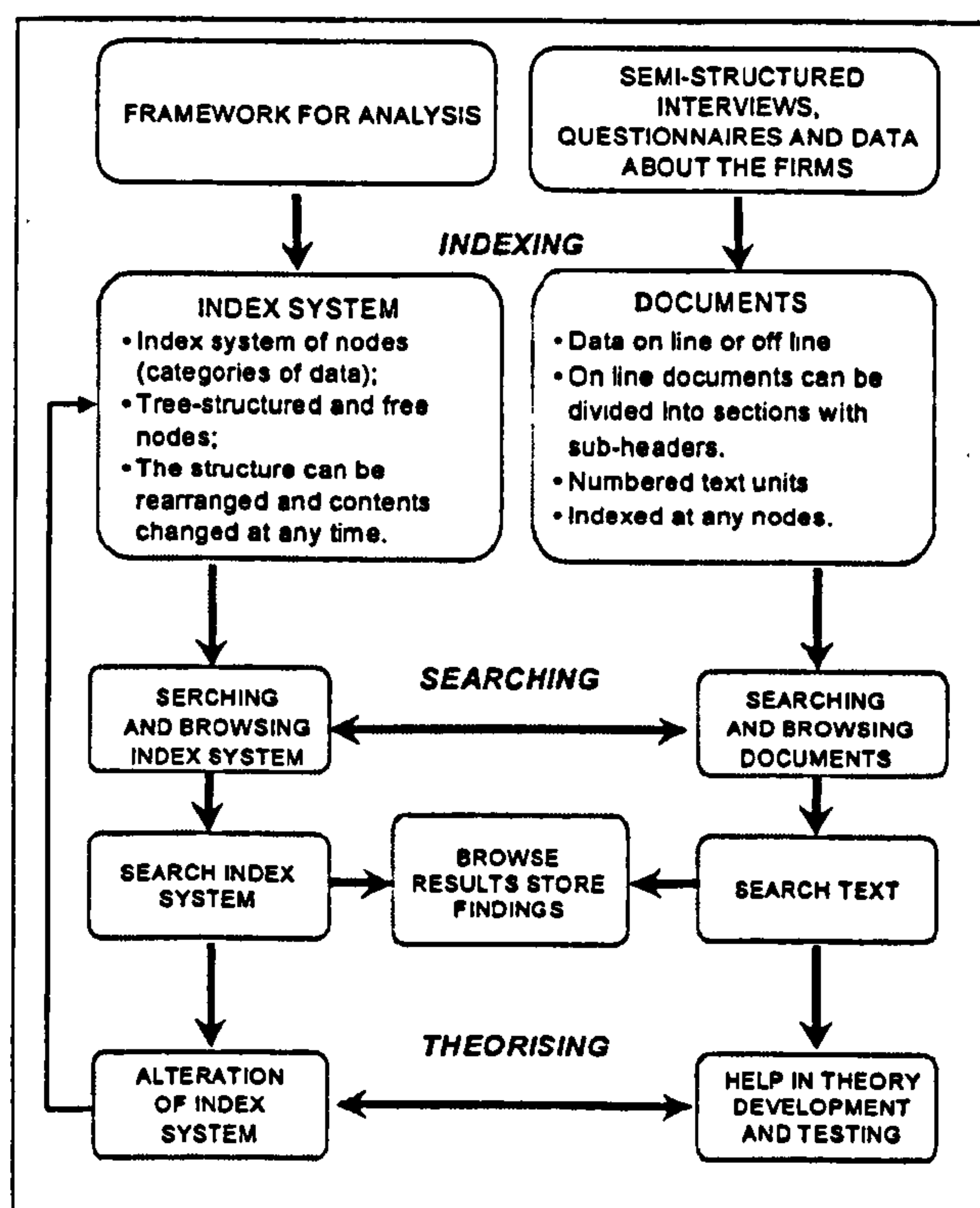


Figure 4.4 - The use of *NUD\*IST* in data analysis.  
Source: Adapted from QSR, 1997.



*NUD\*IST* provided good searching and browsing facilities. It helped in selecting and comparing statements about a given topic. However, some analysis of the data was also conducted through the use of more traditional processes, using the search facilities of the word processor and tables highlighting the most relevant issues (as suggested in Miles and Huberman, 1994). The time spent by the researcher transcribing and translating the data also enabled the researcher to have a deep knowledge about the statements provided by each interviewee, making it easier to find, analyse and compare statements.

In a preliminary analysis of the data, data triangulation was executed. Patton (1987) discusses four types of triangulation: triangulation of data sources (data triangulation), amongst different evaluators (investigator triangulation), different perspectives of the same data (theory triangulation), and of methods (methodological triangulation). Figure 4.2 shows two forms of data triangulation. The first form of triangulation was carried out by comparing the data gathered using different techniques of data collection: interviews, questionnaires and documents. The second, by comparing the data provided by the different interviewees. Theory triangulation was also done by comparing the findings with previous empirical research on the subject and analysing them in the light of existing management theories in order to validate the findings (see chapter 7).

Although a questionnaire was sent to the participants, methodological triangulation has not been achieved because the data collected in the questionnaire was not analysed quantitatively. It was only used for qualitative analysis within the case study process of data collection. Methodological triangulation is not seen as an essential requirement to conduct a valid piece of research, and most studies in the field use only one method of data collection.

When different perspectives were found, the researcher tried to find further evidence, usually by interviewing the same person again or other participants in order to clarify the situation and find a plausible explanation. For example, in *case study 9*, since there were different perspectives about IS/IT adoption and use, five people were interviewed (some more than once) in order to have a deeper understanding about the reasons why there were different views of the process of IS/IT adoption and use in the organisation. The different perspectives were all considered for research purposes and the researcher was able to understand and explain why these different views coexisted in the same organisation. In the cases where the data gathered from the different participants was consistent, only 3 people were interviewed and no further interviews were carried out in the firm.

In one case the data provided by the same participant in the interview and in the questionnaire was inconsistent. In the interview some sensitive issues were raised and discussed. The answers provided were consistent with evidence collected from other interviewees. However, in the questionnaire, later sent (that was signed by the



participant), he expressed a slightly different perspective trying to correct the negative image of the firm he had earlier presented.

The data were summarised using several tables organised by firm, by factor, and by relative level of IS/IT success. Some check-list matrices were developed to analyse the data, as suggested in Miles and Huberman (1994). Several clusters were defined according to the different assessed levels of IS/IT success and extended levels of IS/IT adoption and use. Other clustering alternatives were also evaluated to test and confirm the findings.

A cross-case data analysis was conducted by comparing dimensions in each cluster and by analysing the relative importance of all the factors included in the research framework. The initial findings from factor analysis and cluster analysis were analysed together and consolidated. The factors were then classified into four groups, according to their role and influence in determining IS/IT success. A model was built showing the links and clusters amongst factors. Then the initial findings were also compared with previous literature on the subject and with existing management theory. The objective was understanding the mechanisms related to IS/IT success within a broader context and validate the applicability of management theory, more specifically resource-based theory, to the subject under investigation.

The four key criteria for judging the quality of a research design as proposed by Yin (1994) are: construct validity, internal validity, external validity and reliability. Although this study does not follow a positivist approach to case study research, the tests proposed by Yin to establish the quality of case study research will be discussed within the context and objectives of this study.

*Construct validity* was achieved, first, by using multiple sources of evidence and, second, by establishing a chain of evidence supported by a common and consistent research framework, based on the widely used Pettigrew *et al.* (1989) model. All interviews were based on the same structure, as described in figure 3.1, to ensure that all the factors were addressed by each interviewee. Also the data gathered from the informants were structured and coded in a consistent way for analysis. An extensive analysis of previous empirical research enabled the use of a surrogate measure of IS/IT success that is generally accepted by the academic community – *user information satisfaction*. Since the interviews were recorded on tape, the informants were not asked to review the statements provided, as suggested by Yin (1994). Furthermore, the researcher was concerned that it might have been inappropriate, even not polite within the Portuguese culture, to ask the interviewees to spend further time reading and signing long statements that were previously recorded on tape. In a few cases, informal telephone conversations were held to clarify one or two statements previously given in the interview.



*Internal validity* was achieved by pattern matching. Twelve cases were analysed, which displayed clear patterns across cases that provided valuable insights into the problem under study. The use of a common structure for data collection and data analysis in all case studies (presented in figure 3.1) enabled the researcher to analyse and compare the different cases in order to maintain a chain of evidence throughout the research project. Since most data were collected through semi-structured interviews, the interviewee was free to introduce into discussion any issue that he/she considered relevant. The fact that there are a reasonable number of cases, in different industries, with similar patterns and that data were collected through relatively open interviews, reduces the probability of the phenomena under study being explained by other variables than the ones identified and used in the research.

The problem of *external validity* is concerned with providing generalisation through case study research. As Yin (1994) stresses, case studies do not provide statistical generalisation, and the number of cases studied is not relevant for that. Case studies look for analytical generalisation, and “in analytical generalisation, the investigator is striving to generalise a particular set of results to some broader theory” (Yin, 1994: p.36). However, generalisation is not automatic, a theory must be tested through replication of the findings in one or more cases. The use of multiple case studies enables the replication of the logic through other cases. Furthermore, in this research the findings were analysed in the light of existing theory, which strengthens their external validity.

*Reliability* is concerned with minimising errors and biases in the study. Therefore, a set of procedures must be available to enable a later investigator to do the same research and achieve the same results. Yin (1994) suggests the use of a case study protocol and the development of a case study database. In this research, the questionnaire and the *check-list* of the interviews are presented and their links to the dimensions of the research framework are clearly defined. There is a database structure developed in *NUD\*IST* with all data analysed and another database was created in *Idealist* (a database management system, designed mainly to manage textual information) with case study notes. These notes include data about the profile of the firm, preliminary contacts, interview dates, time spent in each interview, names of the participants and other members of the organisation, financial and commercial data gathered from secondary sources, and other relevant data about the fieldwork. These documents would enable another researcher to conduct a similar study in order to test the findings.

## 4.5 - Summary

Whilst, in previous chapters, the *what*, the substance of the study has been determined, the present chapter addressed the *how*, the question of what research strategy and research design are best suited to achieve the objectives of the study. The next chapter discusses the main case studies according to the adopted research strategy and design.



## **Chapter 5**

### **Case Studies Summaries**

#### **5.1 - Introduction**

This chapter presents a summary of each of the twelve cases studied, structured according to the framework of Pettigrew *et al.* (1989). The data were collected through semi-structured interviews with the key actors in the process of IS/IT development (see table 5.1), by analysing firms' documents and the responses to the questionnaire on IS/IT satisfaction and level of IS/IT adoption. The interviews were conducted in the period of April 1997 to January 1998. Since the identity of the firms that collaborated in the research is confidential, these enterprises will be referred to as *FIRM 1, 2 ...12*. The identity of the people interviewed or mentioned in the interviews is also confidential. Sometimes, the name of the interviewee will be mentioned in the text by his/her initials. All interviews were recorded on tape except one, with the finance manager of *FIRM 12*. Although receptive to answer all the questions, this manager did not consent to have the interview recorded on tape and detailed hand notes were taken instead.

The questionnaire was sent by mail, in March 1998, to most of the interviewees and to some other individuals involved in the process of IS/IT adoption, that were mentioned by the interviewees. The questionnaire was not forwarded to the IS/IT suppliers. About 35 people were mailed and 21 replied. The response rate was 60%. The respondents who did not reply were not contacted again. Some participants had already provided, in the interviews, the information addressed by the questionnaire. In these cases the questionnaire was only used to check and validate the consistency of the responses given. The data gathered through the questionnaire was incorporated into the case study analysis as well as the statements provided in the interviews and documents collected about the firm.

The detailed translation of the relevant parts of the interviews, the questionnaires filled by the participants and documents about the firms can be found in a second volume of the thesis. This second volume has nearly 500 pages and includes all the real names of the interviewees and firms involved, contacts (address of the firm, telephone numbers and e-mail addresses), and other confidential information provided. Table 5.1 exhibits the main characteristics of the participants in the case study research.

The summary and discussion of each case, presented in this chapter, is structured in the following sections: introduction, content, view of success with IS/IT adoption and use, internal context, external context, process, and discussion of significant factors.



**Table 5.1 – Characteristics of the firms involved in case study research**

Case	Industry	Number of Employees	Turnover (million £)	Number of Interviewees	Interviewees
1	Mould	450	16.0	4	CEO (50% owner); Vice-president for operations; Industrial director and IS/IT expert; Former top manager and IS/IT manager.
2	Home textiles	121	4.8	3	Entrepreneur / top manager (50% owner); IS/IT expert; General manager.
3	Cement pipes	196	9.2	3	CEO; Finance and IS/IT manager; Computer system administrator.
4	Mould	138	11.2	3	CEO (major shareholder); IS/IT manager; Finance manager.
5	Clothing	290	8.0	3	Manufacturing & IS/IT manager (shareholder); Finance manager (shareholder); Computer programmer/analyst.
6	Wine	58	6.4	3	Top manager (Admin. and Finance); IT person; Software house supplier.
7	Textiles	340	12.8	3	Top manager (50% owner); Administrative director; IS/IT expert.
8	Footwear	250	6.0	4	CEO (50% owner); Finance manager; IT person; IS/IT expert (software house);
9	Wine	165	20.0	5	CEO (50% owner); Manufacturing manager; Finance and IS/IT manager; IS/IT expert; External software supplier;
10	Clothing	160	11.2	4	CEO (50% owner); Manufacturing manager; IS/IT person; External IS/IT supplier.
11	Footwear	123	4.0	3	CEO (50% owner); General manager; IS/IT expert/vendor (software house);
12	Clothing	350	10.0	4	Finance manager; IS/IT manager / consultant; Computer programmer / analyst; Computer programmer / analyst.

## **5.2 Case Study 1**

### **5.2.1 - Introduction: business characteristics, history and strategy**

*FIRM 1* is a Portuguese enterprise that owns a network of several small firms operating in the engineering and manufacturing of precision injection moulds, for thermoplastics and thermoset resins, and compression and blow moulds. More than 95% of the production is exported. The major customers are Samsonite, Phillips and Electrolux. This group of firms also manufactures moulds for other well-known corporations like IBM, Siemens, Erickson, Alcatel and Black & Decker. In 1996, near 450 people were working for the enterprise and the annual turnover was around £16m.

The main factories and offices are located about 80 miles north of Lisbon. In this area, there are nearly 150 small manufacturing firms operating in the mould industry. Nowadays, *FIRM 1* has two owners (the entrepreneurs) holding a share of 50% each. They both have been working in the mould industry for a long time.

Since its foundation, in 1975, *FIRM 1* had well organised business processes and built proper management systems, although manual ones. The entrepreneurs were of the opinion that the use of IS/IT would be a powerful way of improving business performance.

The mould industry is highly technical and complex, although a considerable amount of craftsmanship is still involved. Generally, the mould manufacturers around the world have very small factories with few people employed. Initially, *FIRM 1* operated more as a trading firm but, in the 1980s, it started to acquire and incorporate small manufacturing firms and developing specialised divisions. In order to finance this strategy of growth, the firm started looking for a business partner. That business partner would be a larger corporation (referred to as *Enterprise R*) with its core business in sugar refinery and investments distributed by several other industries.

Besides providing financial resources for investments, this partnership enabled the access of *FIRM 1* to their IS/IT centre. Moreover, the member of the board of directors that represented *Enterprise R* on the board of *FIRM 1* was an IS expert and a part-time University lecturer in information systems. This person would have an important role conducting the process of IS/IT development in *FIRM 1*.

Specialisation has become an important part of the structure of *FIRM 1*. Nowadays, moulds and specific parts of moulds are produced in different small enterprises of the group. In the 1980s, the enterprise had set up two small factories in Tunisia and Mexico and a commercial office in the United Kingdom employing 4 people.



The group has a central management department for personnel, accounting, administration, financing and planning in one of its locations that operates like a "holding company". There is also a training centre, which provides professional training to young people interested in working in the mould industry and enables employees to learn new skills in order to adapt them to more sophisticated tasks. This training centre has its own building, personnel, three full-time teachers and equipment separate from the factories. Courses are held in areas such as design, IS/IT, CAD/CAM operations and quality control.

One of the firms of the group is a newly set up engineering company in the area of product development, employing 30 people. It uses advanced computer technology, with the aim of providing a shorter development time for products. The firm extended the use of 3D design from mould making to other stages of product conception and development. It employs simultaneous engineering, with prototyping and tooling, and intends to cooperate with the customers in all phases of project development by the use of a recently installed EDI system.

Interviews were conducted with four individuals: the CEO, the vice-president of operations, an industrial director, and a former member of the board (and shareholder). The CEO was previously commercial director of another mould firm. Nowadays, he spends less time in the office because he also is a member of the Portuguese Parliament. The vice-president of operations joined *FIRM 1* in 1986. He is the member of the board responsible for the high technology firm of the group and the training centre. The industrial director joined the group in the early 80s and has more than 10 years experience in CAD/CAM development. The former member of the board and IS/IT manager was also a shareholder until 1991, when he left the firm. This person had a critical role in the development of IS/IT in the enterprise.

### **5.2.2 - Content (type of systems and objectives)**

Investments in IS/IT and in manufacturing technology are a major concern for top management. The firm is proud of being the first European firm in the mould industry (at least in the independent mould industry<sup>1</sup>) to introduce 3D CAD/CAM, in 1984.

Now, the CAD/CAM software includes several standard applications: Unigraphics I, Unigraphics II, Vericut, Work-nc, Autocad, IGES-UG, Master/CAM, and diverse software developed in-house, mainly for format exchange and database systems to record data about the projects. In terms of hardware, several types of computers are being used, VAX stations 3100, a PDP system 11/70, 12 workstations working under

---

<sup>1</sup> In this specific context, a firm operating in the "independent" mould industry means a firm not belonging to a large automobile or aircraft manufacturer, since in those firms the manufacturing processes were confidential and it was not known if they were already using 3D CAD/CAM.



windows NT, and other PCs distributed by the different small firms that incorporate the group.

The enterprise has been using financial and accounting packages, that had been purchased in 1991 from a local software house. These packages are integrated and run on a network system. A software package for human resources management was also installed. Deliberately, this software is not integrated with the previous ones. More recently, communication software for data interchange was implemented to enable on-line development of mould projects in collaboration with the customers. This software has been tested internally and now the firm is trying to convince their customers to adopt it.

*FIRM 1* is also involved in an IS/IT project, financed by European funds, for the development of a software application for production planning and control in co-operation with an industrial organisation. This software runs in Oracle and is being developed according to the specifications of the firm. The vice-president of operations argues that the specifications of the manufacturing processes require specific software. Although it is difficult to develop this type of software, the vice-president of operations has high expectations about its impact in the business.

CAD/CAM is pointed out as having a critical importance in this industry and the recent EDI system is expected to make a significant contribution to accomplish firms' strategy of operating like a "virtual enterprise". The firm wants to be able to offer a superior quality service to their customers by collaborating in all phases of product development. For the vice-president of operations, in order to get benefits for IS/IT adoption it was important to change the existing processes and, at the same time, develop IS/IT:

*It is not enough to have computer programmers and software tools, it is also important to project the mould in a different way to get benefits from the use of the new techniques and technologies. (Vice-president of operations)*

Since a complete product (for example, a vacuum cleaner) may take about 30 to 35 moulds to be manufactured, top management believes that it is important the development of a *global engineering model*. This model will assure that all the moulds (designed in CAD) fit and there will not be any assembly problems. The firm began to use EDI in mould design:

*We are now in the stage of trying EDI. It has been difficult. We have been strategically insisting with people to use EDI... The amount of information that is processed every day is huge, and must be transmitted, inside the organisation and to the customer. If we think that a mould must be ready in 2, 3 or 4 months, we can understand that we are dealing with a large amount of data. (CEO)*

The use of this software is seen as an important strategic factor to be able to co-operate with the customer in the development of the whole product. This co-operation will go



from project design to producing a complete set of moulds for a specific product, plus re-designing it according to market demand and trends. Hence, it is important 'to force' their major customers to adopt the EDI software. Although the system is technically operational its adoption and use by the customer has not been easy. As the CEO reports:

*We also have integrated communications where we can manipulate a design at the same time it is manipulated in the computer of the customer, and we can do it with voice. This has been adopted slowly, more because of difficulties in convincing the customers to use it. (CEO)*

In spite of managers' beliefs that they perform this task better than their customers, most customers do not easily co-operate in delegating to *FIRM 1* their competencies in product design. The new EDI system intends to differentiate the firm by providing a better customer service. As the CEO says:

*Customers' satisfaction goes far beyond the ability to make a working mould at a good price. Communication between the customer and the mould manufacturer is very important, ... in this industry the relationship with the customer has an unusual dimension. (CEO)*

The CEO argues that in many industries it is important that the supplier is located near the manufacturer and, on the other side, Portugal does not have an image of a country with expertise in high technology. He believes that there is no reason why the customer should know that the enterprise is located in Portugal. The use of this communication software is seen as extremely relevant to pursue this strategy and all the efforts should be put here. As the CEO says:

*Customers do not have the system and then there is a temptation to say that the system is not worth having because customers do not have it. I have to fight everyday against that. Now I have less time but I found a person to insist on that. For us, it is a strategic objective that the customer does not know where we are. Since being located in Portugal doesn't bring any competitive advantage, for what reason should we say that we are in Portugal? None. On the other side, we deal with information and the ability of transferring information is inverse to distance...The relationship with a long distance supplier is difficult. Many cars will be made with only one mould. All this information must be used and there is nothing before the mould, which is the first thing. This implies technical problems, manufacturing problems, refrigeration problems, complex machines... It is a huge thing and the customers feel comfortable if the suppliers are located near them. (CEO)*

Although the idea of a virtual enterprise is seen as extremely relevant, from a strategic point of view, the CEO thinks that the industrial director does not easily see it like that. For the industrial director, establishing a communication link in order to develop the product simultaneously with the customer is not perceived as a strategic issue, but as a technology, as a communication element. The CEO fears that when the industrial director contacts customers to suggest that they adopt this system, he does not insist as much as he should in order to convince the customer to buy it. As it happened in the



past, the CEO is having an active role in this process, insisting in the development of internal capabilities and emphasising that the industrial director (who is an IS/IT expert and the person in charge of the project) needs to convince the customers to adopt the same communication technology that is installed in the firm.

*That concept of virtual enterprise is nowadays the most important strategic element for us. However, for the people that are in the 'shop-floor', the industrial director, although he understands it, he does not assume this as he should. He does not easily see that this is a strategic issue. He is seeing it as a communication element. He phones the customer and, if the customer does not have the system, he thinks: 'If the customer does not have it, what can I do?'. The fact that we have those systems before the customer gives us an advantage to learn. (CEO)*

On the other hand, the industrial director pointed out technical problems as the reason why the system is not widely adopted yet. He complains that, since the EDI package, that enables on-line CAD development is recent, it is difficult to get help to solve some of the existing problems.

*We are now installing, this is an experimental phase. It was our idea and we were the only ones that bought the software. Our customers do not have it, yet. The first release is quite new, getting help is difficult. (Industrial director)*

This view is shared by the vice-president of operations (a senior manager, to whom the industrial director reports). He argues that there are also some technical problems, felt by the firm, that constrain the adoption and use of this EDI product. Lack of standards is frequently reported as a major inhibitor.

*It is not easy to implement a communication software with our major customers. We are having problems with protocols, with modems ... Being a pioneer is difficult, but our technicians are already used to this situation. (Vice-president of operations)*

### **5.2.3 - A view of success with IS/IT adoption and use**

The adoption and use of IS/IT in *FIRM 1* can be seen as a case of success. All interviewees agree on that. In the CEO's words:

*...the computerisation of our enterprise has been a complete success. The reason for our success was not only the use of IS/IT, but IS/IT has been very important. ...We have a wonderful, one of the best information systems of Portuguese SMEs. (CEO)*

Both the manufacturing director (and 50% owner) and an industrial director (IS/IT expert) confirmed CEO's views. They declared that were "very satisfied" with the performance of IS/IT in the firm. The vice-president for operations explains that:

*We were pioneers introducing IS/IT in the mould industry. The first CNC equipment in the mould industry was bought by *FIRM 1*. We were also the first ones in the industry to have CAD/CAM...It was probably the group that sooner disseminated the use of PCs*



*... having a 'PC culture' implemented and new software packages emerging in the market, with enough power to satisfy our needs, at an extremely cheap price... (Vice-president for operations)*

*At the moment, we have all the software products that we wanted. We are happy with it and we are happy with the way it was developed. We must always be on the top. (Industrial director and IT expert).*

The former member of the board states that:

*In terms of IS/IT, I would classify the performance of IS/IT in the firm for administrative purposes as a 4, maybe 4.5 (on a scale of 1 to 5) ...IT was a huge success in FIRM 1 because nothing changed. ... The white collar workers of the firm were processing the data in a similar way they were doing before...While manufacturing control, performance evaluation, and cost analysis were running with high success, using a modern solution, better than what we needed by that time, production planning, no. ... We were not able to do it. Even nowadays, I think it wasn't done. (Former member of the board and IS/IT expert)*

According to this manager, at the time *FIRM 1* started computerising its processes, no one in the mould industry was using computers, even for administrative purposes. The use of computers in manufacturing control was also an idea of the two owners of *FIRM 1*, and the firm was far ahead from competitors. However, he reveals that due to the specificity of the industry (a mould is a unique piece without any serial production), the firm was never able to implement MRP.

#### **5.2.4 - Internal Context**

There are two owners, holding a share of 50% each, one of them is the CEO. They are both executives and although the CEO is nowadays a member of the Parliament he is still involved in strategic decision making. The firm has a flexible and flat organisational structure, decentralising responsibility in individual operational groups, which enables the production of prototypes and fast delivery time in areas where the commercial department is independent from the manufacturing one. It is also an objective that customer's interests are represented and defended inside the organisation by the commercial department. By enabling internal collaboration, the organisational structure facilitates the contribution of employees with IS/IT expertise in the process of IS/IT adoption and use. According to the vice-president for operations the group has a sort of 'matrix structure' but with some characteristics of a holding company. Strategic decisions are centralised.

*We defend extremely horizontal structures, flexible ones, with few decision levels and with a "matrix structure". It would take a long time to explain this concept of "organisation in matrix" but it is related to the production of prototypes and delivery time in areas where the commercial department is independent from the manufacturing ones. This concept is associated with the capability of representing the customer inside*



*the firm, crossing horizontally the vertical structures that usually characterise the functional structure of a firm. (Vice-president of operations)*

There is no formal IS/IT department. IS/IT management is centralised in one of the firms of the group, but most of the other firms of the group have at least one IS/IT expert. The IS/IT manager is in a high hierarchical position (vice-president for operations).

Although with limited financial and human resources at the time the company was set up, *FIRM 1* always tried to develop IS/IT knowledge in-house. The link with *Enterprise R* (the sugar refinery) was important and provided access to cheaper hardware. This hardware was sold to *FIRM 1* when upgrades were made in *Enterprise R*. Although the firm initially had to get a bank loan for its first large IS/IT investment in CAD/CAM, financial resources were not referred by the CEO as a significant factor inhibiting IS/IT adoption. The CEO is of the opinion that IS/IT cost is not a major constraint in IS/IT development, as he states: *"being underdeveloped is an advantage as long as we have the right strategy, because the cost of investing in the technology of the XX century is low and the important thing is the ability to change, to differentiate"*.

A qualitative leap, with strong business implications, occurred, in 1983/84, when the first CAD/CAM system was bought. The firm was a pioneer in the adoption and use of CAD/CAM in the Portuguese mould industry and that gave some competitive advantage. Although the firm did not have sufficient financial resources to buy the CAD/CAM system, it was able to negotiate a second hand solution at a reasonable price and receive a bank loan. Furthermore, the CEO is of the opinion that the investment in the acquisition of the first 3D CAD/CAM system was not high:

*The investment in the first CAD/CAM systems was not very high, about 80 million escudos (about £320,000), although, by then, it was a significant investment for a small firm. (CEO)*

According to the CEO, because of his long experience in the business, he believed that 2D CAD was a waste of time and that CAD was only interesting if it was 3D and linked to CAM.

*2D CAD was like an electronic design table, objects were not interpreted by other systems. In 2D, only a technician with experience was able to interpret the object as it really is, by using the rules of design. Only in 3D there is an automatic information recognition and it is possible to use that data without human interference. Hence, the whole process was able to be subsequently used. It was me that concluded that. ... We were interested in CAM. CAD was seen as a problem, because it requires a lot of work. It was expensive to draw complex forms in 3D and no one was really going to pay for the design." (CEO)*

Since *Enterprise R* (the sugar refinery) had a large IS/IT department and the member of the board representing its interests in *FIRM 1* was an IS/IT expert, *FIRM 1* got



additional IS/IT capabilities. This person states that the commitment and conjoint of capabilities of the members of the board was critical for IS/IT success:

*For the success of this case, there is a thing I always believed in, which is the understanding and commitment of top managers. ... as a whole, we had an understanding of the problem and we believed in the solution we had. ... I knew a little bit more about information systems, technology and managerial techniques and they knew more about the mould industry and its market. (former member of the board and IS/IT expert)*

It was reported by the CEO that, with the exception of an American firm called *A1*, the international competitors in the mould industry did not have any idea about what to do with that technology and most of them, for example in Portugal, did not even know it existed. Although the amount of money invested in the first CAD/CAM system was seen as significant for a small firm, the CEO also believes that it was cheap and the return of investment would be shorter than initially expected. The CEO argues that many competitors failed in using 3D CAD/CAM because they did not pay any attention to the process of introducing CAD/CAM into the firm. They were not using the available CAD/CAM technology properly because they did not have a vision how to integrate those systems in the way the firm was operating.

When the CAD/CAM system was introduced, *FIRM 1* did not use any of the existing employees to operate with CAD/CAM. New staff were hired, individuals that had never worked before and did not know anything about projecting moulds. The former member of the board interviewed stated that there were never problems with people

*One thing that was amazing to me was the capability of the kids we hired to use IT. They did not have any problems starting to use the IBM system 34, using floppy disks, terminals, etc. Some of these kids were coming from the fields, farmers, from the countryside. ... There were never problems with the adoption of IT by people. (Former member of the board and IS/IT expert)*

In CEO's opinion, different people, without previous experience in similar tasks, should use the new technology.

*The competitive advantage we got came from fitting the technology into the production line while many other competitors in the world were not looking at that. ... Our world competitors started projecting moulds in 2D. Well, they did not know much about 2D or 3D, they bought a system and the technicians were going to design in 2D. That was the reason why, even before buying, I wrote an internal message forbidding work in 2D and I did not use anyone with previous experience. These are relevant strategic elements. There was no negative reactions because this was a new thing, it was a strange element to the firm. (CEO)*

The learning process is also seen as extremely relevant in the adoption of IS/IT by *FIRM 1*. The development of internal IS/IT capabilities is referred to as an important factor with further implications for the process of IS/IT adoption and use in the



organisation. This view of implementing a learning process influenced the development of the firm's internal capabilities to effectively use IS/IT.

*Another important thing was having a system and then training people to work in 3D. We did wonderful things and then we started to be more confident ... We made a strong effort to learn how to work with IS/IT. We never paid much money for IS/IT or maintenance contracts because the best way for us to learn was doing it ourselves. We created a development team and hired a systems engineer... We forbade the operators to use 2D CAD and we started to have an exceptional capability to work in 3D, and that was a relevant strategic element. (CEO)*

Nowadays, *FIRM 1* has its own training centre for employees, running courses, presentations and workshops about several different subjects, such as operating with industrial machines, CAD/CAM or English.

*FIRM 1 is the only firm in the mould industry that has its own training centre. A long time ago we adopted the policy of not stealing employees from other firms. We decided that we should develop our own people. We get people when they finish their high school education and we give them an intensive training from 6 months to 1 year, full-time, doing real cases but simulated, not real production for the firm. (Vice-president of operations)*

This training centre serves many other firms in the Portuguese industry. According to the vice-president of operations, other firms come and hire the younger employees that received training in the firm, being able to get technical experts at a low cost, because they did not have to invest in training.

Top managers encourage the development of internal competencies to adapt IS/IT according to the specifications of manufacturing processes. As the vice-president of operation expresses:

*We started to be training the whole mould industry. The whole mould industry is indebted to FIRM 1. Other firms came here and hired our employees. It is an inglorious task because we trained them, but if we pay more, our competitors can pay even more because they did not have any training costs and have the equipment there with no one using it. This is a never ending process. They come here and get young people. Of course we try to keep the best ones for us, but the whole sector got benefits because we started training our people. Younger people, better education and a good professional training. (Vice-president of operations)*

*We had no other way than leading this process, training people, investing high, and then trying to keep the best professionals, and try that the ones that go to other firms have a similar professional attitude, a similar culture to the one we have here. ... We believe that we must have demanding customers and suppliers, and hard competitors. That is the only way to improve ourselves. (Vice-president of operations)*

However, since their major competitors are foreign firms, the development of local competitors is not seen as a threat, rather it is seen as a relevant strategic element to



increase the firm's ability to compete in the market. The rise of the mould industry in this area in Portugal is perceived as a success factor for the firm. Since a project requires several different moulds, it seems convenient for the customer to have within a limited geographical area many firms able of producing those moulds. According to *FIRM 1*'s managers, it is not only important to have a good image of the firm in the market but it is also important to have a good image of the region and of the country as a mould producer.

*However, we never saw the development of our national competitors as a problem. It was good for them and good for us. ... We think these firms are important but they should have the same ethical behaviour, the same quality that we have... When a Portuguese mould supplier offers inferior quality, we all suffer. (Vice-president of operations)*

Since the firm was founded, in 1975, the Administration Board emphasised the need to use IS/IT. The specificity of the industry requires the use of high technology and IS/IT was always seen as a way to improve efficiency. However, in the early years, the development of IS/IT was difficult. In the CEO's opinion, entrepreneurs usually have limited views and that constrains IS/IT adoption and use.

The development of internal IS/IT capabilities was seen as an essential requirement. However, although the firm employed IS/IT professionals, in his opinion, these people were making the adoption and use of new IT look like a difficult thing, giving emphasis to their own role in the firm:

*Entrepreneurs are not IS/IT experts and do not have any cultural idea how to deal with IS/IT. They have lack of confidence, too much respect, they think IS/IT is an exceptional thing, extraordinary, difficult, very expensive... we always thought it was a miracle when we were able to do something. The IS/IT people 'fomented' this idea, which is normal. I am not saying I do not understand, it is human nature. (CEO)*

The development of IS/IT in *FIRM 1* was strongly influenced by a top manager who had joined the firm in the early 1980s and who was also an IS/IT expert. This person increased significantly the firm's IS/IT internal expertise and contributed substantially to the adoption and use of IS/IT by bringing a different managerial attitude to the process of IS/IT adoption and use in the organisation. According to the CEO, this manager introduced a very important concept: "no respect for IS/IT".

*For JPS (former top manager and IS/IT manager) IS/IT was a normal thing. He had that attitude that everything is possible and it is possible with few resources and cheap, another thing that we learnt from him. There should be no respect for IS/IT. If there is a problem it should be possible to find a solution. (CEO)*

Other managers confirmed this view:



*Mr JPS was by that time a member of the board, was a very well informed person. He was well documented, used to travel frequently, and was interested in the subject, in IS/IT. He led the change process. (Vice-president of operations)*

Although there were some initial conflicts during the implementation of new technologies, most of these conflicts were not seen as significantly relevant.

*We never felt any internal conflicts in terms of IS/IT adoption and use. I always noticed a high involvement of our employees in adopting new technologies and new concepts, and adapting themselves to those technologies. (CEO)*

However the board of directors had to assume an important role in avoiding conflicts that were related to IS/IT adoption.

*We used to meet regularly in order to analyse problems. ... Employees started to believe that it would be better not to criticise the system. The ones that would do it would have to face us. (former member of the board and IS/IT expert)*

### **5.2.5 - External Context**

In the CEO's point of view, IS/IT suppliers are often not good suppliers and some difficult experiences may happen because managers do not specify exactly what they want. He argues that managers may not even know what they want and having a person on the board with managerial and technical IS/IT expertise is very important. The idea of 'lack of respect' had technical implications in the organisation and the firm became more confident in investing in IS/IT. Furthermore, the increase in IS/IT knowledge enabled the development of better relationships with IS/IT suppliers.

*We started to deal better with that strange world, as equals, because people understood that we knew what we were looking for. We could do business with IS/IT suppliers even about high technology. (CEO)*

*FIRM 1* tries to implement a partnership relationship with their IS/IT suppliers. They chose a local software house to develop the administrative software (financial system, accounting and personnel). Although it is not a large organisation, *FIRM 1* has a good local reputation, which is important for the software house.

*With Datamex (software house) we have found a spirit of collaboration, even because they already understood that they may have benefits because of us and sell more packages. (Vice-president of operations)*

The firm had problems in the past with software houses. In 1994, the accounting and stock management software was replaced by the one from Datamex. Management believed that the previous software was out-of-date and the software house was not capable of improving it in order to satisfy the needs of *FIRM 1*.



Since their customers are large multinational enterprises, they have a strong bargaining power over the firm and managers in *FIRM 1* are frequently fighting to impose their views about adopting interorganisational systems in the business.

*Sincerely, sometimes I think we are more innovators than are large multinational enterprises. ... They see these technologies (IS/IT) as interesting, they have it, but then they do not use it. (Vice-president of operations)*

### 5.2.6 - Process

The whole process of IS/IT adoption and use was carefully managed and, in particular, IS/IT training. The firm developed competencies to manage the process of IS/IT adoption and use.

As it could be expected in an SME, there is no formal planning for IS/IT development in the organisation. Because *FIRM 1* operates in an industry that involves the use of high technology, there are several people working in the firm with engineering degrees that can be classified as IT experts. These people look for the emergence of new information technologies and informally initiate the process of IS/IT development by suggesting its use in the firm.

*People responsible for the different sectors look into the market for new software packages, do tests, and advise the top management about which products to buy. The top management supports the introduction of IS/IT, which is essential in this type of business. (Industrial director)*

The firm has a policy of giving priority to software acquisition instead of in-house development. Only when a software package able to fulfil the internal needs is not available in the market, will it be developed in-house. It was common in the past to produce in-house software for data format exchange. There is also, currently, a project to develop a production planning and control system. Because of its complexity, this software needs to be developed internally.

*Software for production planning and control in the mould industry is very complex. We have plenty of experience to know that it is not easy. We are now testing that software in one firm within the group. (Vice-president of operations)*

The CAD/CAM was selected by top managers, including the CEO, visiting international CAD/CAM suppliers and manufacturing firms that were using CAD/CAM technology. Managers believed that the firm should be looking for a long-term partnership with IS/IT suppliers because, as the CEO explains, “*when we do business with a firm, we will be married for life*”, hence partners should be carefully chosen. Since the strategic impact of these new information technologies was high, the whole board was involved in the process of CAD/CAM adoption. The business strategic view of the board was complemented by the technological expertise of one of its members (Mr JPS).



*Since the beginning we had a clear philosophy about the subject, and time showed that we were right. Basically it was this group of four people that had the perspective of the business, technical knowledge and a vision of the future ... one thing is understanding what a technology can do, another thing is to understand the strategic impact of its use.*  
(CEO)

### **5.2.7 - Discussion of the significant factors**

Managers in *FIRM 1* expressed high levels of satisfaction with the process of IS/IT adoption and use in the firm. The firm has been an early adopter of IS/IT, permanently searching for strategic information systems that can provide competitive advantage. This happened in the past, when the firm adopted 3D CAD/CAM in 1984, and it is happening now with the implementation of an EDI system to enable on-line collaboration with major customers in mould design. Several key factors were identified in the firm as enablers of IS/IT adoption and use:

- The board strongly supports the adoption of new technologies by the enterprise. The CEO believes that investments in new technologies are not expensive and payoff;
- All members of the board of directors were always involved and leading new IS/IT projects and that is perceived as strategically relevant for the enterprise. Because of his experience and strategic vision, the CEO had a strong influence in the way the process of IS/IT adoption has been conducted;
- The development of internal IS/IT expertise was enabled by the existence of a previous shareholder and top manager with extensive experience and knowledge of managing IS/IT;
- A high-technology firm, belonging to the group, was set up to develop, implement and manage the use of new technologies, like the new EDI system. Several IS/IT professionals were hired and their skills were developed in-house;
- The availability of IT experts allow a careful evaluation of software acquisition. As a result, *FIRM 1* started to have IS/IT knowledge, experience in the industry and a strong desire to use IS/IT for improving its business performance;
- The firm has a relatively flat organisational structure and employees contribute to decision making about IS/IT issues. According to the interviewees, there is an “IS/IT culture” in the organisation (i.e. a corporate culture where the use of IS/IT is seen as essential).
- The board exerts pressure on employees to make IS/IT work and manage conflicts related to IS/IT use.



- The firm owns a training centre, and provides training and experts to smaller local mould manufacturers. Top managers believe that providing training to their local competitor is also good for the firm, because it enables the development of the region as a mould manufacturer;
- The board has been involved in IS/IT training. In the past, the manufacturing director (one of the owners, with a share of 50%) learnt how to work with 3D CAD and was, himself, teaching CAD to young operators that were hired from the local population. These CAD operators did not have previous experience working in the mould manufacturing industry;

In summary, the adoption and use of IS/IT in *FIRM 1* is strongly related to management perspectives and attitudes towards IS/IT adoption and use. In this firm, top managers used IS/IT to fulfil the strategic objectives of the firm. The development of internal IS/IT competencies assumes also a relevant role in enabling the management of the process of IS/IT adoption and use.

The initial analysis of the case suggests that the higher levels of IS/IT satisfaction are due to the interrelationship between the elements in the internal context and the process of IS/IT adoption and use. Two interrelated factors assume particular relevance: management perspectives and attitudes, and the development of IS/IT competencies in-house. More specifically, of particular importance was the presence of a person that has IS/IT knowledge, CEO's trust, and a view of IS/IT adoption and use according to the business strategic orientation of the firm. The former top manager, who was also an IS/IT expert, was the "IS/IT project champion". Later, internal IS/IT competencies were developed and a high-technology small firm was set up to manage technological development, including IS/IT.

**Table 5.2 - *FIRM 1*: summary**

Industry	Mould industry (moulds for suitcases, electrical appliances and others).
Year of establishment	1975
Turnover and employees	£16 million and 450 employees
<b>1. Internal Context</b>	
• Organisational resources (financial and human)	Financial resources are available for IS/IT investments. At the beginning, IS/IT investments were enabled by a partnership with a larger firm. IS/IT development is perceived as a strategic issue and IS/IT cost is not a constraint to IS/IT investments.  Qualified human resources. The firm has a training centre to develop their human resources, and supplies people and expertise for the whole local mould industry.
• Management perspectives and attitudes towards IS/IT adoption.	The CEO sees IS/IT as an extremely important issue for the business and supports IS/IT adoption. He is of the opinion that previous success of the business was also due to IS/IT. The administration board is deeply involved in the process of IS/IT adoption and use.
• IS/IT capabilities (IS/IT people and knowledge)	There is a high-technology firm belonging to the group and several IS/IT professionals able to develop or select software. The firm had a previous shareholder and top manager that was an IS expert. He and one of the two owners led the process of IS/IT development in the firm.
• Organisational structure	Matrix structure, but with some characteristics of a holding company. The IS/IT manager is in a high hierarchical position. There are 2 owners (holding a share of 50% each).
• Power relationships (conflicts)	Initially, staff were not receptive to IS/IT adoption. However, top management put pressure on employees to use IS/IT and had an active role in solving potential conflicts related to the implementation of IS/IT.
<b>2. External Context</b>	
<b>External support</b>	
• IS/IT vendors' support	IS/IT vendors' support is perceived as good. Since the firm has prestige in the industry, local software houses are interested in being business partners.
• Consultant effectiveness	No IS/IT consultants ever involved.
<b>IS/IT available (market)</b>	
• Quality of IS/IT available in the market	Not perceived as a problem.
• Quality of IS/IT external expertise & services available	Difficult to find CAD/CAM experts. It takes some years to train people in the firm.
<b>Business Environment</b>	The firm has an active role, putting pressure on customers to adopt EDI based systems. The firm sees this as a service they provide to customers.
<b>3. Content</b>	
• Type of systems	CAD/CAM, manufacturing planning, administrative systems and EDI based systems for on-line product design & development.
• IS/IT objectives	To provide a better and fast customer service by enabling partnership and increasing the quality of the product.
• Evaluation of IS/IT	No formal evaluation of IS/IT costs/benefits.
• Time of IS/IT adoption	Early adopters. One of the first firms in the industry to adopt 3D CAD/CAM, in 1984.
<b>4. Process</b>	
• Stages followed in IS/IT development	IS/IT acquisition. Careful analysis of IS/IT investments involving the board. There was a software development team in the past, but nowadays managers believe it is not worth developing software in-house, except for small programs.
• Models & techniques used	No formal models or techniques used for IS/IT development.
• IS/IT training	IS/IT training provided. The firm has a training centre, providing IS/IT courses for employees.
• People involved.	Key people: CEO, top managers, IT people.



### **5.3. - Case Study 2**

#### **5.3.1. - Introduction: firm's characteristics, history and business strategy**

*FIRM 2* is an SME manufacturing hand-crafted bathroom rugs. The enterprise has 121 employees and turnover, in 1996, was £4.8 million. The firm started adopting IS/IT since its establishment, in 1978. One of the two owners/top managers is supportive of computers and although the enterprise was very small, he employed an IT professional since the firm's foundation, on a part time basis.

In the early 80s, a young IT expert was hired full-time and the firm started to develop manufacturing software in-house. According to that top manager, this person is an excellent IT expert. More recently, the top manager and the IT expert founded a new software house that basically sells the manufacturing control system developed for *FIRM 2* to other firms in the clothing and textile industry.

*FIRM 2* sells a high quality product. It offers "high perceived use value"<sup>2</sup> at higher prices and around 90% of production is exported. The rugs are designed according to market trends and directly sold to small retailers. The firm tries to avoid wholesalers or trading companies. In the UK market well-known retailers, such as Harrods and Selfridges, purchase from *FIRM 2*.

The interviewees in the enterprise were one the two entrepreneurs and top managers (holding a share of 50% each), the IS/IT expert and the general manager. Documents on the business activity of the firm and the existing software for manufacturing control in real-time were analysed.

#### **5.3.2 - Content (type of systems and objectives)**

Most administrative and manufacturing procedures of *FIRM 2* are computerised. In the firm, there are three network servers and about forty PCs. The first server supports administrative applications, accounting, salaries, invoicing, and MS Office applications. The second server is used by manufacturing applications, including a manufacturing control software in real-time. The third server is for software development. All PCs are linked to the network servers and can operate in MS-DOS, Windows 3.1 or Windows 95. The firm has CAD/CAM systems to design and manufacture customised rugs.

There is a high level of IS/IT adoption in the enterprise. The IS/IT person exemplifies this by stating:

---

<sup>2</sup> The concept of "perceived use value" was adopted from Bowman and Ash (1996).

*...we used to have in outbound logistics one person with a PC and 7 printers linked to that PC, one for each type of paper, to avoid changing the paper, for labels, etc. We always assure a good customer service and fast delivery time. (IS/IT expert)*

All software is developed in-house, except applications for accounting and personnel that were purchased from a local software house. The firm recently replaced the old accounting software by a new one, more modern, with a better graphical interface and easy to integrate with the software developed in-house.

Managers argued that manufacturing software must be specifically designed according to the needs of the firm. The firm is proud of its manufacturing control system in real-time that was developed in-house and sells the system to other manufacturing enterprises.

There are EDI links with American agents. A proprietary computer program enables the reception of customers' orders through the Internet. Data are automatically input into the databases of the enterprise.

According to the IS/IT expert and the general manager, IS/IT development in *FIRM 2* enables a fast customer service, which is extremely important for a firm that sells high quality rugs, and reduces administrative costs. It was also reported that the manufacturing control system in real-time has an important function in the firm. The system facilitates the allocation of people to the manufacturing plant because it allows to evaluate in which task an employee is most efficient. The general manager also declares that there is data available on the effectiveness of each manufacturing machine.

### **5.3.3 - A view of success with IS/IT adoption**

All the interviewees show high levels of satisfaction with IS/IT. The top manager/owner clearly argues that the firm has been successful with the use of IS/IT. He is proud of the software for manufacturing control in real-time, and he set up a software house to develop and sell that software:

*A fabulous software for manufacturing control in real-time was developed and used in our enterprise. The objective of that computer firm is to sell that software, which is amazing, a fabulous thing that was developed in the last ten years. (Top manager/owner)*

In spite of the firm having most of its functions computerised, any existing problems or further investments in IS/IT were not reported. As the top manager stated: *"we do not foresee any further IS/IT investments, we have everything computerised"*. The top manager/owner is of the opinion that:

*IS/IT success comes from a partnership between a person that is extremely capable, VS (the IS/IT person) and me, a person with experience of the business... This association*



*between the technical capabilities and the organisational ones is the reason why this works well. (Top manager/owner)*

Since the firm holds a software house, selling software and hardware solutions for the industry, the IS/IT person describes the major IS/IT problems identified in other firms and cites *FIRM 2* as an example of success.

*The most important factor for IS/IT success in manufacturing SMEs is the capability of the owner. See for example the cases of FIRM 2 and FIRM 10 (one of their customers). In FIRM 2 both owners are extremely open to IS/IT development. (IS/IT expert)*

Although the general manager classifies the performance of IS/IT as a 4, he could not foresee significant improvements in the way IS/IT could be used in the enterprise, except for the stock management of finished products and certain statistics that need to be defined by users.

*Not everything is perfect about IS/IT. In terms of performance, I would classify the performance of IS/IT as a 4 (between 1 and 5)... We must improve the way we manage stocks. (General manager)*

However the general manager also stated that: *"we do not have significant problems with IS/IT use in the firm. We have everything computerised since a long time ago. We started in 1978"*.

#### **5.3.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)**

The organisational structure of *FIRM 2* tends to be as flat as possible. As the top manager explains: *"everything is flat. Me and CA (owners) we are on the top and everyone else is immediately below, in one line"*.

The firm has been growing and the top manager refers that the economic and finance situation is very good.

*...we always had a good economic situation, we never had bank loans or commercial bills. Our situation was, from a financial point of view, excellent. We have large capital reserves based on accumulated profits. (Top manager/owner)*

Lack of finance resources was never a constraint to IS/IT development. The general manager expresses this by saying that *"IT costs are not inhibiting IS/IT adoption"*. Investments done in IS/IT in the last 15 years are estimated around £400,000.

Although many employees have a low level of education, significant personal conflicts due to IS/IT use were not reported. Top managers seem to have a good relationship with employees. The top manager/owner interviewed argues that the reason why employees do not show resistance to IS/IT implementation is because IS/IT had always been used

in the organisation, hence when people join the firm IS/IT “*is already there*”. He also states that there is low *power distance*<sup>3</sup> between managers and employees. Top managers frequently participate in social events with employees and there are excellent social conditions, which is uncommon for a firm of the size of *FIRM 2*, including several sports fields and a swimming pool to be used by employees and their families.

For the top manager/owner the performance of the IS/IT person is excellent.

*...since the beginning, 15 or 16 years ago, we hired an IS/IT person and we were lucky because the person we have here is a phenomenon in computer science. (Top manager/owner)*

IS/IT success in the firm is related to combining the business knowledge of the top management with the IS/IT expertise of VS (IS/IT expert).

*I leave IS/IT development with VS (IS/IT expert), but I also get involved myself. This comes from an association between a person that is extremely capable, VS (the IS/IT expert), and me, a person with experience of the business. (Top manager/owner)*

The firm also went a step further and started selling software for the industry.

*...because he (IS/IT person) is very good we created a small software house independent from *FIRM 2* but with the headquarters here, in *FIRM 2*. The aim of this firm is to provide computer services to other firms. It would have been a pity for him to work only here, he is a very skilful person. (Top manager/owner)*

The software house gets advantage by being able to test the software they sell to their customers in *FIRM 2*. Since the software house tends to grow, *FIRM 2* has access to a large set of IT services and to cheaper software, because this software is also sold to other local manufacturing enterprises in similar industries. Because *FIRM 2* does not have many Portuguese competitors there is no risk of improving the competencies of the competitors by supplying the software developed for the firm.

Since the beginning, top managers strongly believed IS/IT would be important for the business.

*...about 15 years ago we hired that young man that developed all of our programs. Everything we have here is developed in-house: invoicing, stock management, etc. everything is done by him. We have everything already done. Therefore, this means we care a lot about IS/IT, because we believe that communication in the enterprise is indispensable. (Top manager/owner)*

Top managers' view on the role of IS/IT in the firm is seen as enabling IS/IT development in contrast to other firms in the industry:

---

<sup>3</sup> The concept of power distance was adopted from Hofstede (1980, 1991).



*Although there are many textile firms in Portugal, managers do not have a long-range perspective, they concentrate too much on the short-range. Many of these textile firms have problems surviving and do not have an idea about the benefits they would get by using IS/IT, they do not know much about IS/IT. I have seen many firms, even belonging to friends of mine that do not know much about IS/IT and are afraid of IS/IT. Because they do not have expertise they avoid using IS/IT. (Top manager/owner)*

The IS/IT person also stresses the importance of top management perspectives and attitudes in the adoption and use of IS/IT in *FIRM 2*. He stated that “*the most important factor for IS/IT success in manufacturing SMEs is the capability of the owner*” (IS/IT person).

The general manager also states that the firm is very innovative, including the adoption of IS/IT, because of the profile of the top managers/owners of the firm.

*The profile and type of management of CE and CA (top managers/owners) is different from the traditional entrepreneur. To be sincere, I have seen many manufacturing firms and I have not seen any like this...Top management has the perspective that IS/IT is important, that the firm can not live without IS/IT and everything must be done to improve IS/IT and the performance of the enterprise. (General manager)*

### **5.3.5 - External Context**

According to the top manager/owner the firm has internal IS/IT knowledge and does not need external IS/IT support. Regarding the use of external consultants he stated that: “*we never had consultants involved, we are the best consultants*”.

The firm tends to develop software in-house except for certain administrative purposes. A new software package for accounting was bought because the older one was out-of-date. Managers are of the opinion that, for manufacturing, packages do not work and it is of no use trying to find one that fits the needs of the firm.

In *FIRM 2*, IS/IT is developed by a small software house associated to the manufacturing firm. The IS/IT expert argues that for manufacturing, software must be specifically developed:

*I do not believe in packages for production management and control in manufacturing SMEs. They have no chance. (IS/IT person)*

On the other hand this development process must be continuous:

*The firm does not have completely stable information systems. If we had standard software we would be dead, but completely dead. (IS/IT person)*

Management believes that a good customer service and fast delivery time are essential for the business. IS/IT adoption is oriented to fulfil those needs. The firm has a dynamic

behaviour exerting some pressure on customers to adopt their software and placing orders via Internet. The general manager explains that:

*Customers do not put pressure on us to adopt new IS/IT, on the contrary, we put pressure on the customers to adopt IS/IT (laughing) ... we are trying that all our agents send us their orders by computer...We believe that this year will get close to 100%. (General manager)*

### **5.3.6 - Process**

The development of IS/IT is centralised in two individuals, the top manager and the IS/IT manager. As the top manager states:

*...my role is to pass on to VS (IS/IT expert) our needs, tell him how it should look like and his role is to execute and develop the programs because I am not a IS/IT expert.... This association between the technical capabilities and the organisational ones is the reason why this works well. (Top manager/owner)*

The IT expert assembles the hardware, develops the software, builds the networks and manages IS/IT in the firm. User training is occasionally provided in-house by the IS/IT expert, when new software is adopted. According to the top manager/owner interviewed, there is no proper evaluation of the benefits achieved with IS/IT use. IS/IT is developed in line with the business strategy of the enterprise.

*There are no problems of integration between systems in FIRM 2. There is also no benefits management or IS/IT evaluation. IS/IT development follows the strategy of the firm. (Top manager/owner)*

The software is developed mainly using Visual Basic and there are no formal information systems analysis and design techniques. However, the IS/IT manager stresses that knowledge of the systems to be computerised is essential for a good software development.

### **5.3.7 - Discussion of the significant factors**

Although *FIRM 2* is a relatively small firm, it sells top quality products to demanding customers and managers expressed high levels of satisfaction with IS/IT adoption and use. The significant factors that contribute to explain these high levels of IS/IT satisfaction are the following:

- Since the firm was established, one of the top managers/entrepreneurs was strongly motivated to introduce IS/IT in the firm. This entrepreneur hired an IS/IT person in the early stages of business growth and had a leading role in the process of IS/IT adoption.



- IS/IT knowledge was developed in-house and, later, a software house to sell manufacturing software was established as an independent business unit. This software house is owned by one of the entrepreneurs/top managers of *FIRM 2* and its IS/IT manager/expert;
- The software house also sells the software developed for *FIRM 2* to other manufacturing firms operating in the same or in similar industries. Since *FIRM 2* is a small enterprise with scarce financial resources, this is seen as a way to obtain funds that enable the development of new computer applications, being ahead of competition in terms of IS/IT sophistication;
- Over the years, employees have become used to IS/IT. There is an environment of IS/IT use in the enterprise, leading to an easy adaptation by users to new computer technologies;
- IS/IT training is provided in-house by the IS/IT professionals of the software house;
- There is in the firm a constant search for improving business processes and finding new ways of doing business using IS/IT. Managers are involved in this search for innovative solutions;
- The firm exerts pressure on its agents to use the EDI services available, designed to receive customer orders directly into the main computer system of *FIRM 2*. This EDI software was developed by *FIRM 2*;
- The firm does not use software packages nor outsources the development of its core manufacturing software. There are two reasons for that. First, managers believe that they would not find software adequate to their manufacturing processes in the market place. Second, they want to develop capabilities in-house in order to be ahead of competitors. The IS/IT manager/expert clearly expresses this view which is also shared by top management.
- There is a strong reluctance to utilise the services of external consultants. Since there is a software house (owned by one of the owners and the IS/IT expert) operating in close partnership with *FIRM 2*, the firm is in a strong position to select software for administrative purposes and easily integrate this software with the existing computer systems.

The internal context was 'cultivated' from the beginning to enable IS/IT development. The continuous search for innovative ways of using IS/IT is enabled by having IS/IT expertise available in an associated software house. As a result, the firm extends its influence outside the boundaries of the enterprise, it puts pressure on customers to adopt EDI systems, and sells its own software to other manufacturing enterprises.



**Table 5.3 - FIRM 2: summary**

Industry	Home-textiles (specialised in high quality bathroom rugs).
Year of establishment	1978
Turnover and employees	£4.8 million and 121 employees
<b>1. Internal Context</b>	
• Organisational resources (financial and human)	Available financial resources. The firm has been profitable and strongly oriented to IS/IT development. Although many employees have low levels of education, they are used to IS/IT because it was introduced since the set up of the firm.
• Management perspectives and attitudes towards IS/IT adoption.	One of the top managers is very interested in IS/IT and strongly supports IS/IT adoption and use. He and the IS/IT expert/manager own a software house.
• IS/IT capabilities (IS/IT people and knowledge)	The firm developed IS/IT expertise in an associated software house. There are three IT staff working for the firm. This enables the development of software for the firm and for the industry. Since the firm does not have strong competitors in Portugal, managers are willing to share their software with other manufacturing firms.
• Organisational structure.	Simple structure, flat and very informal. The IS/IT person is not directly involved in business decisions. The firm is owned by two top managers and their families (50% each).
• Power relationships (conflicts)	IS/IT was introduced since the set up of the firm and staff got used to it. No significant conflicts emerged from IS/IT adoption.
<b>2. External Context</b>	
External support	
• IS/IT vendors' support	No need of external expertise. Software is developed in-house.
• Consultant effectiveness	The top manager interviewed stated that there was no need for external IS/IT consultants
IS/IT available (market)	
• Quality of IS/IT available in the market.	The interviewees are of the opinion that there is no proper manufacturing software available for the industry because it needs to be specifically designed according to the requirements of the business.
• Quality of IS/IT external expertise & services available.	It was reported as difficult to find good IS/IT experts in the market.
Business Environment	The firm exerts pressure on customers (small retailers and agents) to send orders through the Internet. This is seen as very important for the business.
<b>3. Content</b>	
• Type of systems	Manufacturing control in real-time, production planning, administrative software and reception of customer orders using the Internet.
• IS/IT objectives	Reduce administrative and manufacturing costs, and provide good customer service.
• Evaluation of IS/IT	No evaluation of IS/IT costs/benefits. Managers do not even believe in it.
• Time of IS/IT adoption	Early adopters. Since the foundation of the firm, it has employed an IS/IT professional.
<b>4. Process</b>	
• Stages followed in IS/IT development	In-house development. No IS/IT planning or formal analysis and design. IT development follows business needs.
• Models & techniques used.	No formal analysis and design techniques. Software code developed in Visual Basic.
• IS/IT training	IS/IT training provided in-house by the IS/IT manager/expert.
• People involved.	Key people: One top manager/owner and the IS/IT person.



## **5.4 - Case Study 3**

### **5.4.1 - Introduction: firm's characteristics, history and business strategy**

*FIRM 3* is an enterprise that operates in the fibro-cement industry, producing cement pipes and slabs. It was established in mid 1940s and continued to grow into a larger firm. Products are mainly sold in the domestic market, although exports have recently been increasing. For many years, the firm used to operate in a situation of oligopoly because the Portuguese market was protected and considerably close to foreign competitors. In the 1970s, *FIRM 3* started to grow in becoming shareholder of several other smaller firms, including a software house. This software house was created in a partnership with two other firms and its first task was to provide IS/IT services to *FIRM 3*.

In the 1980s, external competition increased. The firm did not sell differentiated products and competition is based on price. The organisational structure of *FIRM 3* was strongly hierarchical and too inflexible to face this increasing competition. Furthermore, emerging environmental problems related to the use of asbestos (an important raw-material) and a decrease in market demand forced the firm to induce organisational changes. A re-engineering process was undertaken in the late 1980s, aiming to increase competitiveness. New and more functional buildings were bought. The shares owned by *FIRM 3* in enterprises outside the fibro-cement industry, including the software house, were sold in order to free resources and to concentrate efforts on the core business. Meanwhile, the software house is very successful and is nowadays one of the largest IS/IT companies in Portugal.

In 1986/87, new IS/IT was implemented and many organisational processes were changed. Within ten years, the number of employees has reduced from 490 to 196 staff. A multinational company, also operating in same industry, became shareholder of *FIRM 3*. This enabled access to new markets and manufacturing processes. The CEO, a professional manager at the head of the firm since 1987, led the re-engineering process. He is a former finance manager who had been hired by the firm in 1979. According to the CEO, *FIRM 3* is currently in a far better economic situation. In 1996, turnover was £9.2m.

The CEO, the finance & IS/IT manager, and the computer systems administrator of the firm were interviewed. An external IS expert was also informally interviewed in order to confirm some issues. Documents on the firm's manufacturing processes and products, and on the existing computer systems were analysed. The researcher also analysed an article on the re-engineering process of *FIRM 3*, which had been published in an SME's journal (Zorrinho, 1994).



#### **5.4.2 - Content (type of systems and objectives)**

There is integrated software covering administrative and manufacturing procedures. This software runs on a RISC PowerPC from Motorola and there are about 37 terminals. The IS/IT project started in 1986 but only since 1989 the firm started to use an integrated management system. All the software was specifically developed for *FIRM 3* except the human resource management application and the new accounting program. Modules include: statistics, stock management, accounting, sales, purchasing, invoicing and some manufacturing routines, analysing the time and cost spent on manufacturing products. Most of the software was developed by the software house that belonged in the past to *FIRM 3*. Manufacturing applications were developed in-house by a computer programmer who was working for both organisations, *FIRM 3* and its software house.

According to the CEO, the objectives for the adoption of a new management information system were basically: redefining the organisational structure and processes; better organisational control; to increase team work; and to fulfil the need to have fast, correct and integrated information. However, it was mentioned that another objective, to reduce the amount of paper used in the enterprise, was not achieved.

The finance manager, who is also the person responsible for IS/IT, explained that the current computer system was implemented because it was necessary to replace the older one, but there was no cost/benefit analysis.

*It was the discontinuance of a system that was out-of-date and that could not be improved and we should do the best we could with our own resources. That was the tendency followed, not a cost/benefit evaluation. (Finance & IS/IT manager)*

#### **5.4.3 - A view of success with IS/IT adoption and use**

IS/IT had an important role in the re-engineering process of *FIRM 3* and managers expressed satisfaction with IS/IT adoption and use in the firm. However, some problems related to IS/IT were found in the organisation. The CEO is attentive to the performance of IS/IT and involved in its development.

*In terms of hardware, the system is having a sensational behaviour. We only had a problem two years ago and they (the software house) came here to see what it was. Meanwhile, we updated the system...(the computer system) instead of stimulating productivity was dissuading productivity. People were waiting for the data while the computer system was working. I noticed that and two years ago I decided to invest in IS/IT with the aim of increasing speed and make access easier. (CEO)*

In the enterprise, IS/IT is aligned with the business strategy. Although there are no formal procedures to evaluate IS/IT benefits, the finance/IS/IT manager is of the opinion that IS/IT benefits are higher than IS/IT costs.



*The cost/benefit analysis is positive. In our case there was a strategy and the information system was one part of it. An information system implemented without a strategy may not bring any benefits. (Finance & IS/IT manager)*

Although the finance & IS/IT manager revealed that there were several problems in the implementation phase, nowadays he shows high levels of satisfaction with IS/IT.

*The implementation period was bad, it was too long, people were affected and got traumas. I do not wish to anyone what we had to go through in the years between 1986 until 1988/89... The performance of IS/IT in the firm maybe classified between 4 and 5 (5, excellent and 1, poor). There are things here that we can not improve, they are already perfect. However, there are other things that can be improved. Globally, maybe I would classify it as a 4. (Finance & IS/IT manager)*

#### **5.4.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)**

The shareholders of *FIRM 3* are a multinational manufacturing company and some Portuguese entrepreneurs. The shareholders are not directly involved in the management of the firm, they simply control results. The CEO is a professional manager who intends to make the organisational structure leaner and flatter, decentralising responsibility and stimulating executives to do operational tasks. IS/IT is used to enable this process of cost reduction. As the IS/IT & finance manager explains:

*...in May 1988, we had about 476 people, by the end of 1996 we had only 196 people and a similar turnover ...only by appealing to high technology we would be able to overcome the lack of human resources. (finance & IS/IT manager)*

There is a functional structure, however the division of tasks may not be seen as a classical one:

*I have a peculiar type of organisational structure, completely different from what one may see in management books. The purchasing department is subordinated to the manufacturing department ... the manufacturing manager is a person I trust and in order to buy raw-materials it is important to know the manufacturing processes. ... If I see that there is a sector without much work, I tend to put another sector there, even knowing that from a theoretical perspective it should not be like that. (CEO)*

There are two IS/IT professionals. The individual responsible for the IS/IT department is the finance manager. The CEO and the financial manager, who has some IS/IT expertise, have an important influence on the development of IS/IT in the enterprise. The computer systems administrator (one of the two IS/IT professional in the firm) holds a degree in economics but she does not have much IT expertise neither does she plays a significant role in decision making.

The firm has been investing into IS/IT substantially to improve processing speed, around £60,000 into the first computer system and £60,000 into the second one. A



European project provided funding for IS/IT training. Since the firm has a good reputation and cultivates a strong relationship with the software house, software was purchased at a low cost.

*We got specially designed software but that was not financed by us, we would not have money to finance a project like this. The software house financed it. Since we are a firm with a good and well-known name in the market, they wanted to take our experience and to develop a package that they could sell to other firms. (CEO)*

The process of IS/IT adoption was difficult because some senior employees did not have any computer education. Although IS/IT training was carried on, according to the CEO, people do not use computers as extensively as they should.

*There was a lack of computer education. I think that the new generation is different. People go to the computer and they get what it is there but there is no dialogue with the system... We only use about 30% of what the computer system may provide us. (CEO)*

The firm has two people working in the IS/IT department. However, these people can not be classified as IT experts. For example, neither of them is able to program computers. The computer system administrator does not have the profile of an IT person, she holds a management degree and has no previous IT education. According to the CEO, her main advantage is her ability in attending to users.

*The computer systems administrator does not have much IS/IT education. She is not a person so fond of IS/IT as I would like her to be... I would like her to improve her knowledge in computer programming but enthusiasm should start from her. However, she compensates it with knowledge about the system, with rigor, with security. If you ask me if I would not like to have another person with a different profile, I would say 'yes'. In life, one always wants more. We will see, maybe one day. It will depend on our needs. We should not invent needs. If I felt that I need more from IS/IT, I would not exclude her, but I would probably have to complement her with a person with a different profile. However, in terms of the business, I can not see, immediately, where I can get benefits by doing that. (CEO)*

In the past, there was a computer programmer working for the firm. This computer programmer came from the software house that was owned, at that time, by *FIRM 3*. The CEO of *FIRM 3* states that, since a long time ago, he has been a personal friend of the CEO of the software house. This personal relationship enables *FIRM 3* to have easy access to IS/IT knowledge. The finance & IS/IT manager confirms this.

*IS/IT services were provided by a software house that is an associated company. ... We were on the 9<sup>th</sup> floor and the software house was in the 11<sup>th</sup>. We only needed to go upstairs, there was a family type of relationship... *FIRM 3* sold its share in the software house. However, we are friends and the IS/IT services provided by the software house have been remarkable, in response time and finding the appropriate means to fill our needs. I can only speak well about them. (Finance & IS/IT manager)*



The finance & IS/IT manager explains the lack of capabilities to develop software in-house.

*...since a significant part of the code is developed externally we do not need to be on the edge of knowledge. (Finance & IS/IT manager)*

All the interviewees referred to some negative reactions from employees towards IS/IT use.

*At the beginning there were some problems of adaptation to those changes. Later, people got used to it. ... For some people, if someone talked about IS/IT they almost got sick; others used to have other excuses, they might say that they could not use the computer because of their eyes; other ones did not have any skills or desire to use IS/IT. However, a favourable environment was created so that everyone could naturally learn how to use the system. (Finance & IS/IT manager)*

*...there is always a reaction to the implementation of computer systems. It is a new thing and people are afraid of not being able to work with it. (Computer systems administrator)*

The CEO and the IS/IT manager hold similar views on IS/IT adoption and use in the firm. The engagement of top management in IS/IT adoption and use is perceived as critical to achieve high levels of satisfaction with IS/IT.

*I do not believe in a project like this without a complete involvement of the CEO. People start talking in the corridor, rumours that the guy (CEO) said this, that he smiled about it, that he does not agree, and the people that are involved in the IS/IT project are completely crucified. It is necessary a complete engagement and involvement from the top down to the bottom. When people complain it is necessary to say: 'I already told you it must be done in this way, and that is all!'; 'do not tell me that!'; 'not today', etc... Then, what happens is that by the end of it you will find that everyone was agreeing with it. This is a natural thing in life. (CEO)*

*In order to be successful with the implementation of IS/IT it is necessary the global engagement of top management, otherwise things won't work. For me, that is a relevant factor. On the other side, campaigns to explain to users that the future is in this type of systems and the involvement of all is needed in order to make it work...It is fundamental to have unit of command, clear objectives, to say: " this is the way where we are going, no matter who will be hurt, no matter how much it will cost". It must have a complete protection in all areas by the administration and directors. That was achieved here. (Finance & IS/IT manager)*

The CEO and the finance & IS/IT manager were deeply involved in the process of IS/IT adoption and use, changing organisational processes and putting pressure on employees to use the computer system. According to the CEO, the computer systems administrator also had an important role in avoiding conflicts in the enterprise.

*If you arrive there irritated, complaining because you wanted to do something on the computer and you can not, I assure you that you will leave her office, relaxed, calm,*



*and not angry. The systems administrator has the merit of instead of replying, she pays attention, she is polite, serviceable and helpful and people forget, trust her, and relax.*  
(CEO)

#### **5.4.5 - External Context**

The software house had an active role in the development of IS/IT in *FIRM 3*. In the past, the firm belonged to *FIRM 3*. After becoming independent, the excellent relationship between both top managers contributed to sustain access to good technical support. *FIRM 3* does not use external software except that developed by the software house. There were no contacts with other IS/IT suppliers. The computer systems administrator, although she has been in the firm for ten years, expressed that she does not know much about the IS/IT market because the firm did not do any search for software available in the market.

#### **5.4.6 - Process**

The CEO and the finance & IS/IT manager are deeply involved in the process of IS/IT adoption and use and there has been a strong link with a software house supplier that developed most of the software used in the enterprise. Some other applications were developed in-house by a computer programmer that also worked for that software house. University lecturers were involved in IS/IT training but the development of human resources was difficult. Nowadays, there is no in-house software development. Neither of these two IS/IT people are able to write computer code. Software maintenance is done by a hired IS/IT expert that works part-time for the firm or by the software supplier.

#### **5.4.7 - Discussion of the significant factors**

Although showing positive levels of IS/IT satisfaction, in the past, the firm had some problems related to IS/IT adoption. The significant factors found related to IS/IT adoption and success will be presented:

- There is a strong relationship with a software house that used to belong to *FIRM 3* until 1989. The business relationship with this IS/IT supplier is reinforced by the fact that both CEOs are close friends. This enables the firm to have easy access to IS/IT knowledge. The software house developed an integrated software system for *FIRM 3*, designed according to the business requirements of the enterprise.
- There is a strong involvement of the CEO and the IS/IT manager in the process of IS/IT adoption and use. The CEO was directly leading this process and puts pressure on employees to use IS/IT. Top managers perceive IS/IT as an element of the global business strategy of the firm.



- The enterprise has an IS/IT department, with two people full-time, that is supervised by the finance manager. However, the role of this department is to provide user support and administering the central computer system. IS/IT development is executed by the partner software house.
- The firm relies on the software house for improving its computer systems. Although the software house is a close partner and provides support to computerise the existing business processes, this solution inhibits a more innovative use of IS/IT in the firm. Although top managers believe IS/IT adoption is strategically important, there is not a continuous search for new ways of using IS/IT to improve the business. The finance/IS/IT manager states that since software is developed externally, the firm does not need to be on the edge of knowledge.

The firm has a less active behaviour than some others firm studied that have achieved higher levels of IS/IT satisfaction. Whilst those focus their efforts on developing IS/IT knowledge and on improving the internal context, this firm is more oriented in getting IS/IT products from a close partner. The firm gets the computer systems it needs but there is no “leverage effect” to develop knowledge and find innovative IS/IT solutions.

**Table 5.4 - *FIRM 3*: summary**

Industry	Cement pipes and slabs.
Year of establishment	1945
Turnover and employees	£9.2 million and 196 employees
<b>1. Internal Context</b>	
· Organisational resources (financial and human)	Limited financial resources for IS/IT investments, although this is not seen as a significant constraint. The development of human resources was difficult and still is perceived as a weakness of the firm. Funds provided by an European project enabled IT training courses to be run in the firm.
· Management perspectives and attitudes towards IS/IT adoption.	There was a strong effort to rationalise procedures and reduce costs. IS/IT enabled a re-engineering process in the firm. The CEO and the finance manager strongly supported IS/IT adoption and consider it as a critical way to increase competitiveness.
· IS/IT capabilities (IS/IT people and knowledge)	Although there is an IS/IT department, the two IS/IT professionals are not computer programmers, they are systems administrators. A software house, founded and owned in the past by <i>FIRM 3</i> , provides software and IS/IT services. Both CEOs are personal friends and that is seen as essential to support the business relationship.
· Organisational structure.	Functional structure. The firm has been flattening the organisational structure. The CEO is a professional manager, not an entrepreneur and the IS/IT manager is the finance manager. Capital ownership is held by several shareholders.
· Power relationships (conflicts)	The CEO had an important role in avoiding IS/IT conflicts. According to the CEO, the profile of the computer systems administrator also helped solving conflicts related to IS/IT adoption.
<b>2. External Context</b>	
<b>External support</b>	
· IS/IT vendors' support	There is a strong relationship with a software house that provides IT services and software. Managers are quite satisfied why the services provided.
· Consultant effectiveness	External experts run IT and management courses.
<b>IS/IT available (market)</b>	
· Quality of IS/IT available in the market.	The partner software house developed an integrated IS/IT solution meeting the business requirements of the firm.
· Quality of IS/IT external expertise & services available.	Not a significant issue.
<b>Business Environment</b>	The organisation did not exert pressure on suppliers, nor reported filling pressure from customers to adopt IS/IT.
<b>3. Content</b>	
· Type of systems	Integrated software for manufacturing management and administrative transactions.
· IS/IT objectives	Reduce organisational structure and costs; Provide a faster customer service.
· Evaluation of IS/IT	No formal evaluation of IS/IT costs/benefits.
· Time of IS/IT adoption	The IS/IT project started in 1986 but only in 1989 the firm was using an integrated management system.
<b>4. Process</b>	
· Stages followed in IS/IT development	Software specially developed by the partner software house or changed in-house by a computer programmer that works full-time for the software house and part-time for the firm.
· Models & techniques used.	Software is outsourced. None of the two IS/IT people of the firm is able to write computer code.
· IS/IT training	IS/IT training provided in the past by University lectures.
· People involved.	CEO, IS/IT manager (also finance manager), IT people and IS/IT experts from the software house.



## **5.5 - Case Study 4**

### **5.5.1 - Introduction: business characteristics, history and strategy**

*FIRM 4* is a recently established enterprise, founded in 1993 and operating in the mould manufacturing industry. In 1996, turnover was £11.2 million and the firm had 138 employees. Customers are large multinational enterprises in the automobile industry or manufacturers of electrical appliances. Saab, Volvo and Electrolux are some of the major customers. *FIRM 4* is industry leader in Portugal (with *FIRM 1*). Fast delivery time is an important requirement in the industry and *FIRM 4* tries to add *perceived use value* on the service they provide.

Although independently managed, there is a strong link with a well-known Portuguese group. The enterprise is 100% family-owned. The CEO is 28 years old and is one of the shareholders. The firm has been making large investments in IS/IT, mainly in CAD/CAM. The CEO sees IS/IT as an important issue in competing in the industry. Since the firm was recently set up, there are a large number of young engineers who enable an environment of IS/IT innovation. Interviews were conducted with the CEO, the CAD/CAM systems manager (IS/IT manager) and the finance manager.

### **5.5.2 - Content (type of systems and objectives)**

There is extensive use of CAD/CAM software running on a Windows NT network. In this industry CAD/CAM is critical for the business. However, some difficulties were reported in the past finding programs to convert data formats used by different CAD systems.

EDI and a videoconference system are available in the enterprise. The use of EDI was suggested by some of the customers - large automobile manufacturers. The CEO explains that the firm is using video-conferencing because it enables a quick contact with major customers and reduces the cost and time spent travelling.

There is also software available to support production planning and control. This software is now starting to be installed but the characteristics of the mould industry make it more difficult to be applied in this type of firm. The IS/IT manager (CAD/CAM systems manager) reveals that the existing software to evaluate the cost of a mould is basically manual and besides CAD/CAM, there is no sophisticated software for manufacturing available in the firm..

*The system we have to evaluate the cost of the mould is basically manual. Each operator fills in a 'time-card', saying how much time he spent with each mould. Then we send the data to a database in order to estimate the cost of the mould. We are now trying to link it with manufacturing management. We are trying to develop a system*



*with terminals in the manufacturing plant. Each operator uses that terminal to say where he is and how much time he spends with the mould. (CAD/CAM systems manager / IS/IT manager)*

The existing administrative software is reported as out-of-date and does not include invoicing. In the opinion of the finance manager there is no major need for an invoicing system. There are not many transactions in the firm, although the amounts of money invoiced are large. Nevertheless, the firm is now thinking about purchasing an application for invoicing.

The CEO reported that the administrative software used by the firm covers basic purposes only. *"For administrative purposes we do not have 'heavy' computer systems. We use packages that we buy and software we develop in-house."* (CEO)

### **5.5.3 - A view of success with IS/IT adoption**

The use of good CAD/CAM systems is seen as critical for the industry. As the CAD/CAM systems manager affirms: *"in terms of IS/IT we use the top technology"*. The CEO stated that, with CAD/CAM the firm only had problems with some "bugs" common in the new releases. According to him, *"in FIRM 4 there are no significant problems with the implementation of IS/IT"*. He believes that *"people, I won't say are very happy, but are happy with what we have"*.

The CAD/CAM systems manager and the finance manager also reported that they were generally satisfied with the performance of IS/IT in the firm. The remaining software, besides CAD/CAM, is not very sophisticated and they both reported some minor problems related to the administrative software.

For the CAD/CAM systems manager (and IS/IT manager) the problem with the administrative software is mainly due to dependency from the software house. This software is a proprietary system developed by a German software house and *FIRM 4* depends on the software house to maintain or improve the performance of the application.

*The administrative system runs in a proprietary Unix system, from the German software house. That is our problem, we are dependent on a proprietary system. It is dangerous, one day they may close and we will have a problem. The software is excellent. It is more the problem of dependency on the proprietary system. (CAD/CAM systems manager / IS/IT manager)*

The finance manager has a different opinion. He reported that the administrative software is out-of-date and its performance is less than satisfactory. However, he is also of the opinion that although the administrative software is not the best in the market, it is sufficient for the needs of the firm. In his point of view, this software is less important for the enterprise than the manufacturing software, CAD/CAM or EDI based systems.



## **5.5 - Case Study 4**

### **5.5.1 - Introduction: business characteristics, history and strategy**

*FIRM 4* is a recently established enterprise, founded in 1993 and operating in the mould manufacturing industry. In 1996, turnover was £11.2 million and the firm had 138 employees. Customers are large multinational enterprises in the automobile industry or manufacturers of electrical appliances. Saab, Volvo and Electrolux are some of the major customers. *FIRM 4* is industry leader in Portugal (with *FIRM 1*). Fast delivery time is an important requirement in the industry and *FIRM 4* tries to add *perceived use value* on the service they provide.

Although independently managed, there is a strong link with a well-known Portuguese group. The enterprise is 100% family-owned. The CEO is 28 years old and is one of the shareholders. The firm has been making large investments in IS/IT, mainly in CAD/CAM. The CEO sees IS/IT as an important issue in competing in the industry. Since the firm was recently set up, there are a large number of young engineers who enable an environment of IS/IT innovation. Interviews were conducted with the CEO, the CAD/CAM systems manager (IS/IT manager) and the finance manager.

### **5.5.2 - Content (type of systems and objectives)**

There is extensive use of CAD/CAM software running on a Windows NT network. In this industry CAD/CAM is critical for the business. However, some difficulties were reported in the past finding programs to convert data formats used by different CAD systems.

EDI and a videoconference system are available in the enterprise. The use of EDI was suggested by some of the customers - large automobile manufacturers. The CEO explains that the firm is using video-conferencing because it enables a quick contact with major customers and reduces the cost and time spent travelling.

There is also software available to support production planning and control. This software is now starting to be installed but the characteristics of the mould industry make it more difficult to be applied in this type of firm. The IS/IT manager (CAD/CAM systems manager) reveals that the existing software to evaluate the cost of a mould is basically manual and besides CAD/CAM, there is no sophisticated software for manufacturing available in the firm..

*The system we have to evaluate the cost of the mould is basically manual. Each operator fills in a 'time-card', saying how much time he spent with each mould. Then we send the data to a database in order to estimate the cost of the mould. We are now trying to link it with manufacturing management. We are trying to develop a system*



*with terminals in the manufacturing plant. Each operator uses that terminal to say where he is and how much time he spends with the mould. (CAD/CAM systems manager / IS/IT manager)*

The existing administrative software is reported as out-of-date and does not include invoicing. In the opinion of the finance manager there is no major need for an invoicing system. There are not many transactions in the firm, although the amounts of money invoiced are large. Nevertheless, the firm is now thinking about purchasing an application for invoicing.

The CEO reported that the administrative software used by the firm covers basic purposes only. *"For administrative purposes we do not have 'heavy' computer systems. We use packages that we buy and software we develop in-house."* (CEO)

### **5.5.3 - A view of success with IS/IT adoption**

The use of good CAD/CAM systems is seen as critical for the industry. As the CAD/CAM systems manager affirms: *"in terms of IS/IT we use the top technology"*. The CEO stated that, with CAD/CAM the firm only had problems with some "bugs" common in the new releases. According to him, *"in FIRM 4 there are no significant problems with the implementation of IS/IT"*. He believes that *"people, I won't say are very happy, but are happy with what we have"*.

The CAD/CAM systems manager and the finance manager also reported that they were generally satisfied with the performance of IS/IT in the firm. The remaining software, besides CAD/CAM, is not very sophisticated and they both reported some minor problems related to the administrative software.

For the CAD/CAM systems manager (and IS/IT manager) the problem with the administrative software is mainly due to dependency from the software house. This software is a proprietary system developed by a German software house and *FIRM 4* depends on the software house to maintain or improve the performance of the application.

*The administrative system runs in a proprietary Unix system, from the German software house. That is our problem, we are dependent on a proprietary system. It is dangerous, one day they may close and we will have a problem. The software is excellent. It is more the problem of dependency on the proprietary system. (CAD/CAM systems manager / IS/IT manager)*

The finance manager has a different opinion. He reported that the administrative software is out-of-date and its performance is less than satisfactory. However, he is also of the opinion that although the administrative software is not the best in the market, it is sufficient for the needs of the firm. In his point of view, this software is less important for the enterprise than the manufacturing software, CAD/CAM or EDI based systems.



The finance manager also states that the firm has excellent CAD/CAM systems. In his opinion, the EDI system and the manufacturing software, although performing satisfactorily, could be improved.

#### **5.5.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)**

The firm is performing very well from a financial perspective and large investments including IS/IT are being planned. The CEO states that he is willing to invest in IS/IT, in order to improve the existing manufacturing processes. The availability of financial resources also enables large IS/IT investments. The CAD/CAM systems manager confirms this.

*We are on the top about using IS/IT. From a technological perspective, everyone in this organisation has a philosophy of being ahead of competitors. There is also an unusual attitude on the part of the bosses, they encourage spending money. In 1993, initial IS/IT investments cost more than 150 million escudos (about £600,000). In 1994, we did an upgrade costing a further 60 million escudos (£240,000). In early 1996, we bought 5 computers and we spent more than 20 million escudos (£80,000). This only in CAD/CAM, I am not talking about PCs and networks which cost about 20 million escudos (£80,000). (CAD/CAM systems manager)*

The mould making industry is a particular industry where CAD/CAM systems are the core software of the business. CAD/CAM systems are complex computer applications and can not be easily developed in-house. Therefore, the firm searches for this type of software in the market. There is an internal context enabling the development of IS/IT expertise but with little emphasis on other types of applications besides CAD/CAM.

Since the enterprise was established recently, many CAD/CAM operators hold University degrees in engineering and others have previous IT experience acquired in other firms of the group. This is seen as a success factor. The CAD/CAM systems manager argues that:

*The major problem with the implementation of IS/IT may be the adaptation of people to new technologies. ... That is more difficult. That can not be found in FIRM 4 because it is an enterprise recently established and workers are relatively young. (CAD/CAM systems manager)*

The finance manager also states that it is an aim of the firm to hire people with University degrees and that the firm pays well, above the average of the industry.

IS/IT knowledge is developed in-house. This knowledge is not really applied in developing IS/IT applications but in the management of software acquisition. There are fifteen staff working in CAD and nine in CAM, the core applications of the business. According to the interviewees, employees request the use of IS/IT in their tasks.

*People accept IS/IT well. That is not a problem. The heart of the mould industry now is computer programming. (CEO)*

The CAD/CAM systems manager is being careful implementing IS/IT. He is aware of the social impact of the adoption of new information technologies.

*The implementation of an integrated computer system must be carefully studied. It is expensive and it affects the daily work of a blue collar workman. Machine operators will be directly controlled by computer and this must be done carefully, but sooner or later we must do it, it is important. (CAD/CAM systems manager / IS/IT manager)*

#### **5.5.5 - External Context**

CAD/CAM software is bought in the market. The selection process is lead by the CAD/CAM systems manager (IS/IT manager) with the help of other IS/IT experts of the firm. Since there is IT knowledge in-house, *FIRM 4* never used the services of IS/IT consultants.

The firm does not influence its business partners to use IS/IT, mainly because these are very large manufacturing companies. Since there are several people with IS/IT expertise in the firm, it responds well to the IS/IT demands of the business. Interviewees stated that it is easy to dialogue with IS/IT suppliers when selecting software.

The quality of the software available in the market is not perceived as a significant problem. The technical support provided by IS/IT suppliers is seen by the CAD/CAM systems manager as good.

#### **5.5.6 - Process**

The IS/IT manager plus other managers and IS/IT experts are permanently looking for new software. The young engineers that are working for the firm have a dynamic role searching for recent computer tools. The CEO supports IS/IT adoption and use but he is not much involved in the process. He delegates that task to the CAD/CAM systems manager.

Although there are IS/IT experts in the firm, most software is acquired in the market. The firm adopts IS/IT as soon as it recognises in those systems business value. However, it does not put pressure on customers to use interorganisational information systems.

IS/IT costs/benefits are evaluated by the CAD/CAM systems manager. In spite of a careful evaluation of the IS/IT products acquired, there are no formal models or techniques used to manage IS/IT.



*We are evaluating how much the implementation of the manufacturing software would cost. In the case of FIRM 4, the pay-back of the IT investment is expected to take two years. It is usual to evaluate IS/IT costs and benefits in-house. Usually I am the one that does that. (CAD/CAM systems manager / IS/IT manager)*

According to the interviewees, IS/IT training is provided in-house by highly qualified external experts. These courses cover essentially Microsoft Office applications and CAD/CAM. In the area of CAD/CAM the firm frequently uses international experts for providing IS/IT training.

#### **5.5.7 - Discussion of the significant factors**

The firm had the opportunity to implement modern computer systems due to the fact that it had recently been established, in 1993. There is a strategy of growth. The firm has financial resources and has been making large investments in technology, including IS/IT. The significant factors related to IS/IT adoption and success are the following:

- The CEO supports IS/IT development but he is not involved in the process of IS/IT adoption. The IS/IT manager, formally the CAD/CAM systems manager, is empowered to make IS/IT decisions;
- Since the firm is recent, when it was established many young engineers with IS/IT education were hired. These people have an active role participating and co-operating in the selection, adoption and use of CAD/CAM and other manufacturing information systems. They also contribute to adapting the new computer systems to the processes of the enterprise;
- There is no significant in-house software development. CAD/CAM is the most important type of software for the firm and these systems are essentially bought in the market. Other types of applications for administrative purposes have a secondary role and are out-of-date but they do not represent a major concern for management;
- *FIRM 4* does not have a proactive behaviour in terms of developing or contracting out the development of innovative IS/IT solutions, but it continuously searches in the market for existing IS/IT applications that can be used in the business, mainly in the area of CAD/CAM.

There is a limited use of IS/IT in *FIRM 4*. The firm concentrates its resources in developing CAD/CAM and manufacturing systems, there is little emphasis in adopting and improving IS/IT for administrative purposes.



**Table 5.5 - *FIRM 4*: summary**

Industry	Mould industry (moulds for the automobile industry and electrical appliances).
Year of establishment	1993
Turnover and employees	£11.2 million and 138 employees
<b>1. Internal Context</b>	
• Organisational resources (financial and human)	The firm is in a healthy financial situation and large investments, including IS/IT, are being planned. It has qualified human resources. Because the firm is recent, most CAD/CAM operators are engineers. Several users have previous IS/IT experience.
• Management perspectives and attitudes towards IS/IT adoption.	The CEO is a young manager (28 years old) and supports IS/IT investments. He sees IS/IT as an important issue to compete in the industry. Relationships are very informal and all staff are able to suggest IS/IT changes.
• IS/IT capabilities (IS/IT people and knowledge)	The firm employs a large number of engineers with IS/IT expertise. These people suggest IS/IT changes. The most important software is CAD/CAM, hence there is no significant in-house IS/IT development.
• Organisational structure.	Functional structure. The IT manager (CAD/CAM systems manager) is a top manager. Capital belongs 100% to the CEO and his parents.
• Power relationships (conflicts)	The firm is recent and employees are all very young, and there is an informal environment. This is perceived as a reason why there are no internal conflicts related with IS/IT adoption.
<b>2. External Context</b>	
<b>External support</b>	
• IS/IT vendors' support	Software is bought in the market. The IS/IT manager (CAD/CAM systems manager) has a major role in the selection process.
• Consultant effectiveness	'Consultants' used only for IS/IT training.
<b>IS/IT available (market)</b>	
• Quality of IS/IT available in the market.	The quality of IS/IT available in the market is not seen as a constraint. There are CAD/CAM systems available (a critical software for the business). However some difficulties were reported, in the past, in finding programs for data exchange between different CAD systems.
• Quality of IS/IT external expertise & services available.	The firm hires young people with University degrees and trains them in-house. This is seen as a success factor of the firm.
<b>Business Environment</b>	EDI and a videoconference system are available. The firm adopts new IT as soon as it recognises business value in it, but does not put pressure on customers to use those systems.
<b>3. Content</b>	
• Type of systems	CAD/CAM systems, manufacturing planning and control, administrative software and telecommunication technologies (EDI and video-conferencing)
• IS/IT objectives	Fast delivery time and mould precision.
• Evaluation of IS/IT	No formal evaluation of IS/IT costs/benefits.
• Time of IS/IT adoption	The firm was recently set up (1993) and the IS/IT infrastructures were developed from the beginning.
<b>4. Process</b>	
• Stages followed in IS/IT development	Essentially IS/IT acquisition. IT people evaluate carefully the software acquired in the market.
• Models & techniques used.	No use of formal models or techniques for IS/IT management and development.
• IS/IT training	IS/IT training provided by qualified external experts.
• People involved.	The IS/IT manager and other IT experts. The CEO supports IS/IT adoption but empowered the IS/IT manager to manage the process of IS/IT development and acquisition.



## **5.6 - Case Study 5**

### **5.6.1 - Introduction: Business characteristics, history and strategy**

*FIRM 5* is a knitwear enterprise that manufactures medium to high quality jumpers and pullovers. The firm resulted from a fusion, in 1983, of three firms in the clothing industry. About 95% of production is sold in the domestic market with own brand names. There are about 1200 customers and turnover, in 1996, was around £8m. In 1987, a management-buy-out operation took place and the enterprise is now owned by several top managers. The CEO has a dominant share, owning 55% of the firm.

In this decade, the firm started to change its product-mix to face new market trends. While in the past, a collection of products was based on two or three brands, each one with 20 or 30 different models, nowadays, there are about 12 brands, with hundreds of models in each brand. The business activity is characterised by the production of small orders and quick response. According to the finance and administrative manager, in this industry, enterprises that do not follow fashion and do not invest in technology will be “out of business”, because Asian and South American enterprises do nowadays exactly what the firm used to do in the past, and they are more competitive.

The enterprise has an IT department since its foundation and administrative software was initially developed in-house. In the early 1990s, the firm started a project with a software house to develop manufacturing systems, including MRP and a manufacturing control system in real-time.

### **5.6.2 - Content (type of systems, objectives)**

The firm has an IBM AS/400 with 30 terminals running administrative applications, such as, general ledger, accounting, invoicing, and payroll. The administrative software was tailored to the needs of the enterprise. It was first built in-house, using RPG, and later outsourced to an external software house supplier.

In 1992, *FIRM 5* started implementing a manufacturing control system in real-time. There are about 250 terminals collecting data on productivity and manufacturing times. These data are used to define the standard cost of each manufacturing process. There are other programs for production management, orders and stocks. The firm also uses CAD/CAM technology. Manufacturing applications run on a Compaq server with 10 PC terminals. These applications are integrated amongst themselves but not integrated with the administrative software. The firm is also installing some internal EDI links to process customer orders from the showrooms in Lisbon and Oporto to the factory. Data will be transferred and integrated in the central computer.



A previous software for manufacturing control was developed by a firm that has closed since. The software house that is developing the current software picked up that system, changed the software, and kept some of the hardware (250 light pens and the IBM RISC 6000 computer). Later the IBM RISC 6000 was replaced by a more powerful computer.

The objectives of IS/IT adoption and use were broadly defined in terms of reducing costs, reducing delivery time, and increasing productivity. There were not defined precise targets or evaluation procedures. However, both the manufacturing and the finance manager argue that it would not be difficult to conclude that the benefits from IS/IT adoption and use were higher than its costs. The finance manager is of the opinion that the manufacturing control system in real-time increased productivity by 25% to 30%, even in the period where the system was not working. Since the terminals were there, in the working place, only its presence was forcing workers to change their behaviour. The manufacturing manager holds a similar opinion.

### **5.6.3 - A view of success with IS/IT adoption**

For the finance manager IS/IT is having a an important role in the evolution of the firm:

*We could say that if FIRM 5 had not adopted these new computer systems it would have been difficult to be in the place we are nowadays. (Finance manager)*

The finance manager considers the firm a “*case of success with IS/IT adoption*”. The manufacturing manager states that IS/IT brought benefits in terms of productivity increases and a better organisation of operations. A computerised system puts pressure on people to have procedures about what must be done. The manufacturing manager is satisfied with the performance of the manufacturing systems:

*In manufacturing management, from 0 to 100, we have reached 95%. There is always 5% that we keep improving. (Manufacturing manager)*

Furthermore, the manufacturing manager stated that, on a scale from 1 to 5, he would rate the performance of the IS/IT in the firm between 3 and 4. Using the same scale, the IS/IT expert interviewed classified the performance of IS/IT in the firm as 3.

### **5.6.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)**

The manufacturing manager is 36 years old and the person formally responsible for IS/IT. He holds a first degree in engineering and he is son of the CEO, the major shareholder of the firm. The CEO owns 55% of the business and leaves most of IS/IT decisions to his son, who has some IT expertise.



The finance manager is an economist and one of the five shareholders of the firm (with 8.5%). While the manufacturing manager selects IS/IT for manufacturing, the finance manager chooses the administrative software.

*There is a certain division of roles. The decision of going for that application in manufacturing was mine. About the AS/400, the administrative system, is more with the finance manager. (Manufacturing manager)*

The firm has been making large IS/IT investments. However, IS/IT costs were never seen as a constraint to these investments, even when the firm was in a difficult financial situation, before the management-buy-out.

Although the manufacturing manager believes that about 80% of employees can use computer systems, some minor problems related to IS/IT use have been reported. For example, the manufacturing manager states that data are not input directly into the computer in the showrooms because "our salesmen are 40 or 50 years old and are not familiar with the use of computers...".

The enterprise has an IS/IT department with three IS/IT professionals (two experts and one assistant). However none of these people have IS/IT knowledge about the new manufacturing systems that the firm is implementing. The IS/IT professionals started working in the firm a long time ago, when the firm was using punched cards technology, and do not know much about new IS/IT.

The manufacturing manager (also IS/IT manager) has some IT knowledge acquired at University but he is not an IS/IT expert. He asserts that he would like to develop IS/IT knowledge in the enterprise:

*We want the IS/IT department to know how to make changes in this new application, they must learn the programming language, so that we will not depend on IT suppliers... I think that our IT people should start learning the basics of the new manufacturing software ... they must be able to make small changes and provide maintenance. (Manufacturing & IS/IT manager)*

In the past, administrative software was developed in-house, using RPG, but later software development was outsourced to different software houses and there is no integration between administrative and manufacturing applications. However, the manufacturing & IS/IT manager would like to have those systems integrated. He believes that IS/IT people can do that in-house.

*Initially all software was developed by us. Then we started to have an IBM agent, Quatro, that developed our software for accounting, invoicing, payroll, etc. (IT person)*

*Theoretically, there would be advantages in having an integrated software system. That is why I think people in the IT department must adapt themselves to the new IS/IT, they must improve, they are young (40 years old) they are interested in improving*



*themselves. If they were at the end of their careers, it would be difficult.*  
(Manufacturing manager)

The finance manager reports some resistance from employees to use the manufacturing control system in real-time.

*We introduced this manufacturing control system in real-time not only to increase productivity but to change the mentality of employees. Without a change in mentalities this can not go on... Even nowadays, although these systems are operating, we are 99% satisfied, there still is a group of women that still do manual records. This does not mean that they did not adapt themselves to the new system. However, at the same time, they also use a pen to do a manual record because they also want to control it and they believe more in a manual system...* (Finance manager)

On the other side, the manufacturing manager states that now people are not afraid of using office software. The IS/IT expert also reveals that “*nowadays, employees react better to IS/IT adoption. I was even surprised with some people, not young, that got used to this*”.

The CEO does not get much involved in IS/IT matters. The manufacturing manager leads the process of IS/IT adoption and use in the firm:

*My father (the CEO), at the beginning, he did not look at IS/IT with the importance he should have given to it, but now he has surrendered to IT. He does not involve himself, information is transmitted to him but he does not use it much, except on few occasions...* (Manufacturing manager).

### **5.6.5 - External Context**

There were some problems in the past with the software house supplier that provided the initial manufacturing control system in real-time. The software house closed and *FIRM 5* could not get support. However, the IT firm that supplied the hardware (*Efacec*) started a department to build manufacturing applications and they developed the software according to the requirements of the business:

*Efacec operates with us like a business partner and we get some benefits from that. We are not interested in ‘canned solutions’. Things must be done according to our measures and sensibility, and this sensibility is many years old.* (Finance manager)

*We also saw other types of software systems for manufacturing. We chose this one because the others that exist, are not Portuguese (they may belong to foreign firms with agents in Portugal), and there is always problems. Their agents may not be as qualified as they should and it will be difficult having foreign people here providing technical support.* (Manufacturing manager)

*Efacec analysed our system. They have experts in several areas. They are all engineers, and must have about 300 or 400 people. They have experts according to the area. Now they have here other people to develop manufacturing planning and stock*



*management, although there is always a person that is a systems analyst that supervises it all...Efacec gives us a warranty of continuity. It is a large company and it is having good financial results. There are firms where the firm that develops the software may not have problems but the agent in two or three months may have disappeared. (Manufacturing manager)*

However, the finance manager also reports that sometimes the software house uses the firm to test software that it is not ready.

*They also took advantage of us and were here testing the latest applications of Windows NT that have errors. ... They are using us as 'guinea pigs' for their experiences. (Finance manager)*

All the interviewees expressed satisfaction with the support provided by the existing software suppliers:

*We are happy with Quatro. Since there will be problems with year 2000 and with the new European currency ("Euro"), we have a warranty that our software will be adjusted to it. (IT person)*

They have never involved consultants in the process of IS/IT development in the enterprise:

*We never had any consultants or external entities co-operating in IS/IT adoption, only us and Efacec. (Manufacturing management)*

The manufacturing manager stated that there are not many suppliers providing manufacturing software solutions for the industry and the changes that occurred in the business environment forced the firm to respond by adopting new IS/IT. According to the finance manager, IS/IT is very important for the firm in order to face market changes.

*IS/IT had an important role, and it will have in the future, enabling us to satisfy the market, because the market changed, tastes changed. There are many models now and faster delivery time. Without the use of IS/IT this could not be possible. (Finance manager)*

Furthermore he states that:

*Working with fashion requires this processing capability because, nowadays, the market demands a lot from manufacturers and one can only have good productivity levels with the help of IS/IT. Otherwise, it would have been necessary to have a large number of people, both for information processing and manufacturing...In 1987, we had 600 employees. Nowadays, in 1997, 10 years later, we have 290 employees. This is because of the use of new technologies and the objective of reducing costs. (Finance manager)*

Since customers are small retailers, the enterprise never felt any pressure directly from customers to adopt IS/IT solutions.

### **5.6.6 - Process**

The CEO is not much involved in IS/IT decisions. The manufacturing manager, the finance manager and one of the IS/IT professionals handle IS/IT decisions. The manufacturing manager and the IT professional are the computer systems administrators. A large software house developed the manufacturing software. A significant part of the administrative software was developed by a previous software house and the computer programmers of the firm also developed some administrative routines.

According to the manufacturing manager, IS/IT success in the firm is related with developing tailored applications:

*Starting from zero has its advantages. It takes more time, but the software is designed exactly according to our needs because we participate in its development... We were involved in the process, we defined what we wanted. They tried to build the software according to what we wanted. Meanwhile, the system is also tested and new ideas appear. (Manufacturing manager)*

The manufacturing software is being developed using SQL Windows and it has a friendly user interface. There is no formal systems analysis. As the IS/IT expert explains:

*We analyse the requirements and then we write the code. There is no use of formal systems analysis techniques. (IS/IT expert)*

By the end of each module, there is a course for the users of the manufacturing software provided by the software house experts. According to the manufacturing & IS/IT manager, the software house provides all the necessary support. Employees also attend courses in office applications.

### **5.6.7 - Discussion of the significant factors**

Managers now express positive levels of satisfaction with the process of IS/IT adoption although, in the recent past, they were disappointed with it. The firm had a negative experience with a previous software house supplier and managers were happy to be able to find another software house that was just starting developing production management systems. There was a dependency on that software house that meanwhile closed, leaving the firm with incomplete IS solutions in manufacturing. A discussion of the key issues related to IS/IT adoption and use follows:



- Manufacturing systems are being designed according to the requirements of the business by a software house that is a business unit of one of the largest Portuguese manufacturing enterprises. IS/IT is developed in line with the business strategy of the firm, with the aim of reducing costs, providing quick response and managing smaller orders.
- The firm has an IS/IT department with three people (two senior computer programmers and one assistant) and a manufacturing (and IS/IT) manager with some IS/IT knowledge and power within the organisation, because he is also the son of the major shareholder. This facilitates communication with the software house.
- The software house also gets benefits by testing its software in *FIRM 5*. Sometimes, this is also seen as having negative repercussions in the firm. The finance manager is of the opinion that the software house takes advantage of the firm, testing there their new applications that still have errors.
- Although the manufacturing & IS/IT manager is confident that the software house supplier will be operating in the market for a long time, he would like to increase IS/IT knowledge in-house, in order to avoid the errors of the past. He puts pressure on IS/IT staff to start learning the programming language used in the development of the new computer applications. He also would like to have access to the source code of the software.
- The two senior computer programmers have been in the firm for a long time. They are used to programming in RPG and do not feel comfortable programming in modern computer languages (like SQL Windows). This is inhibiting the development of IS/IT competencies in-house.
- Although there is a close supervision, by top management and IS/IT staff, on the process of IS/IT adoption and use, the firm is still dependent on the external context to improve IS/IT.

Although the firm employs some IS/IT professionals, it contracts out the development of its core computer applications. The manufacturing/IS/IT manager and the IS/IT staff closely supervise the process of software development. Furthermore, top management is focused on changing the internal context trying to improve IS/IT knowledge to adapt and develop software in-house, avoiding the errors of the past, and not being dependant on IS/IT suppliers.

**Table 5.6 - *FIRM 5*: summary**

Industry	Clothing industry (knitwear).
Year of establishment	1983 (it was a fusion of 3 other firms).
Turnover and employees	£8 million and 290 employees
<b>1. Internal Context</b>	
• Organisational resources (financial and human)	The firm did significant investments in IS/IT, about £220,000 in the last years. Availability of financial resources for IS/IT investments was never reported as a problem. Some minor problems related to IS/IT use were reported due to the age of employees and their limited IS/IT education. Some employees are not completely adapted to the use of the manufacturing control system.
• Management perspectives and attitudes towards IS/IT adoption.	Managers interviewed reported a strong support towards IS/IT adoption, although the CEO is not much involved in the process of IS/IT adoption. The development of IS/IT in the firm is led by his son, an engineer with some previous IT education.
• IS/IT capabilities (IS/IT people and knowledge)	Since a long time ago, the firm has an IT department, with 2 people providing IT services. In the past, these people developed in-house accounting software. The manufacturing manager has some (limited) IS/IT education.
• Organisational structure.	There was a management-by-out and the CEO owns 55% of the firm. The firm has a functional structure. The manager of each department (manufacturing or administrative) is responsible for IS/IT in his own area. The manufacturing manager (and son of the CEO) has a critical role in IS/IT adoption and he is informally the IS/IT manager.
• Power relationships	Not reported as a relevant issue.
<b>2. External Context</b>	
<b>External support</b>	
• IS/IT vendors' support	The interviewees are satisfied with the services provided by the software house.
• Consultant effectiveness	No consultants involved in IS/IT adoption.
<b>IS/IT available (market)</b>	
• Quality of IS/IT available in the market.	Software for manufacturing needs to be developed according to the specifications of the enterprise. There is an emphasis on manufacturing software.
• Quality of IS/IT external expertise & services	Not reported as a relevant issue.
<b>Business Environment</b>	There was no business pressure to adopt EDI. Customers are small retailers. However, the firm thinks about EDI adoption.
<b>3. Content</b>	
• Type of systems	There is an integrated software for administrative and manufacturing purposes, which includes a manufacturing control system in real time. The firm is also considering the installation of an internal EDI system.
• IS/IT objectives	Reducing people in the administrative and manufacturing areas. Enabling a better response time and customer service.
• Evaluation of IS/IT	No formal evaluation of IS/IT benefits.
• Time of IS/IT adoption	The firm is an early IS/IT adopter, since the foundation of the firm.
<b>4. Process</b>	
• Stages followed in IS/IT development	The interviewees identified a systems analysis phase.
• Models & techniques used.	Not identified by the IT person.
• IS/IT training	Provided by IS/IT vendors.
• People involved.	Key people: Manufacturing and finance manager, IT staff, IS/IT professionals from the software house.



## **5.7 - Case Study 6**

### **5.7.1 - Introduction: business characteristics, history and strategy**

*FIRM 6* was established in 1964 and its shareholders are co-operatives of wine producers. The shareholders are several local associations of wine producers. The enterprise has 58 employees and £6.4m turnover. Most production is sold in the domestic market to supermarkets and large retail stores. The firm has more than 1,000 customers and these receive the product through the firm's own distribution system. The product is a medium quality one and there is a strong competition in the market based on price.

The members of the board of directors are not executives and only meet in the firm once a week. The finance manager and the manufacturing manager have a major role in IS/IT development. There is also a person in the firm with some IS/IT expertise. Interviewees were conducted with the administrative manager, with an IS/IT person (an employee with some IS/IT expertise), and with a professional from the software house supplier (IS/IT vendor). An informal conversation was also held with the manufacturing manager.

### **5.7.2 - Content (type of systems and objectives)**

The firm has used IS/IT since the 1980s but it has low levels of IS/IT adoption. There is a software package for accounting, from *Infologia* (a software house), complemented by tailored software to manage stocks and invoicing developed by a local software house. The objective of IS/IT is to provide a faster data processing and good stock management. There is no significant strategic impact of IS/IT for the business. According to the interviewees, the stock management application is the major concern and needs to be improved. Nowadays, some large retailers are demanding EDI systems and the firm is implementing those systems with the support of the local software house.

### **5.7.3 - A view of success with IS/IT adoption**

The administrative manager argues that:

*Problems are not in the standard software, everything is OK with accounting. We have problems with the specific software... In terms of specific software, I confess it was not been 100% well done. In Portugal, at the moment, we do not have many people able to do it...I believe this has failed because we have information needs and we have to wait a long time to get solutions. I can understand it may not be easy to find computerised solutions, attending to the requirements we have. We want everything integrated, we do not want separated solutions...Classifying the performance of the software (on a scale from 1 to 5) ? I would say 3. We already have several things working well, although none particularly good. (Administrative manager)*



The IS/IT person has a similar opinion although he expresses a more positive level of satisfaction with IS/IT:

*I would classify the performance of IS/IT in the firm as a 4 (between 1 and 5). We are not 100% well, but I think we are going well. (IS/IT person)*

The IS/IT vendor recognises that the manufacturing system is far from satisfactory although he minimises its relevance.

*The problem with IS/IT development in FIRM 6, if we can call it a problem, is the number of business transactions they have. There is a large number of transactions...Managing the returnable bottles are their most critical problem and that gave us hard work. We partially solved their problems but I still believe there is a small problem there that we still need to solve. (IS/IT vendor)*

#### **5.7.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)**

The board of directors has five people but none of them are executives. They meet in the firm once a week and the administrative manager is the person that rules the firm, except in manufacturing, where the manufacturing manager has autonomy. There is a functional structure and both administrative manager and the manufacturing manager have a major role in IS/IT development. Although the administrative manager is heading the firm, she avoids making decisions directly related to manufacturing, because she does not have any manufacturing expertise. There are also conflicts of perspective between the administrative manager and the manufacturing manager.

The firm has spent about £40,000 in IS/IT, most of it on hardware. Although it was reported that the board supported all the IS/IT investments suggested, because there are many shareholders the board tends to delay decision making and avoids taking risks, being afraid of criticisms from the shareholders.

There is very low IS/IT knowledge in the firm. Only one person has some, limited, IS/IT expertise and he is not working full-time in IS/IT. According to the administrative manager this person can only solve small problems. The administrative manager states that she would like to have more knowledge about IS/IT.

*I confess, it is a pity I do not know much about IS/IT. There is lack of people in this area and those have different ideas, even the ones that know the subject. I haven't found consensus amongst them. I do not mean that we are in a bad situation (in what concerns IS/IT) but we are not where I would like to be. (Administrative manager)*

According to the IS/IT vendor, decision making is very slow. Due to the organisational structure of the enterprise, directors avoid taking risks and that affects IS/IT adoption.



*Another characteristic of FIRM 6 is the time they spend for decision making. Decisions are usually global agreements amongst all the members of the board. The board meets only one day a week and they decide based on reports from the other managers. First, someone must provide a technical report, then a second technical report. People do not want to take risks...A decision can be delayed 3,4 or 5 weeks before it is made. They say: " We must think. Are you sure it will work? How much does it cost?". Decision making is much slower than it should be and that affects the effectiveness of the system. (IS/IT vendor)*

The IS/IT person has a similar opinion although he explains that the board supports IS/IT adoption and use.

*There was never anything suggested about IS/IT and refused by the board. It may be delayed, but if it is necessary they support its acquisition. (IS/IT person)*

Internal conflicts between the administrative manager and the manufacturing manager are reported as affecting IS/IT development.

*People that lead manufacturing are not much open to change. They got used to having certain procedures, specific routines. They are not sensitive to change. They are afraid that the computer may make errors...The most important thing for IS/IT success in this enterprise is co-ordination between all sectors. There must be team-work, a strong will to achieve the objectives... (Administrative manager)*

*Mr CB (manufacturing manager) and Mrs MC (administrative manager) do not have a good relationship between them and that plays against us. In order to prejudice others interests they may say that the computer system is not working well, and it affects us... I try to have a good relationship with everyone and sometimes I even have to try solving problems amongst people to avoid being affected by that situation. (IS/IT vendor)*

Although some negative reactions to IS/IT use have occurred in the past, nowadays employees show a positive attitude towards IS/IT use.

*I have never noticed any resistance of people related to IS/IT adoption. People even like to use IS/IT. (IS/IT person)*

*FIRM 6 had worked before with IS/IT and people did not have problems adapting themselves to the new computer system. (IS/IT vendor)*

### **5.7.5 - External Context**

The vendors support is reported as technically satisfactory, but according to the finance manager they take too much time to solve problems because of lack of resources. People from the software house also operate as IS/IT consultants.

*People in the software house have too much work and they do not answer well to our problems. It is not because they are not capable, it is due to the fact that they do not have time, they do not have means to provide support. (Administrative manager)*

It was reported that there is a need for better software solutions, mainly in manufacturing. The firm never had a full-time IS/IT person and the administrative manager does not have a good impression about the IS/IT services available in the market. However, there is low knowledge about the software available in the market.

*In the 'software house', they already know what we want and we keep asking them to solve our problems. They say they are working on it, but things take a long time... Basic features are already working, but the development of the new requirements becomes more complicated. (Administrative manager)*

The administrative manager states that she will not change the IS/IT supplier because they already developed some of the software and to change it again, now, would be difficult.

*Since we chose to use IS/IT we must do it with the same people, otherwise it would be a problem. How could I put someone else here and change the existing computer programs? I would have to change everything! We would only be able to change the software that is not integrated. The delays we have in IS/IT development may be due to its cost and the time they need to make those changes, those programs are complex...we must not forget that we have to get resources from outside, in terms of hardware, software and advisors. ... I confess that those external resources many times are not good. (Administrative manager)*

#### **5.7.6 - Process**

Software is not developed in-house, the firm basically buys software. The software supplier does some information systems analysis in order to adapt their software to the enterprise. Since the members of the board are not executives, the manufacturing and the finance manager are very important in the process of IS/IT adoption. The IS/IT person reveals that: *"decisions about IS/IT adoption start with the board of directors and with Mrs MC"* (Administrative manager).

The IS/IT vendor uses some structured analysis techniques for software development. There is no formal IS/IT training, as the IS/IT person states *"people learn by using the computer"*.



### **5.7.7 - Discussion of the significant factors**

The firm has low level of IS/IT sophistication. However, it is not successful with IS/IT adoption and use in the enterprise. The following key factors were identified as inhibiting IS/IT adoption and success:

- The firm did not develop IS/IT knowledge in-house and the administrative manager recognises that since she does not have much IS/IT expertise, it is difficult for her to identify IS/IT solutions for the business;
- The firm depends on external software houses and IT suppliers. The administrative manager complains that the support provided by the IS/IT supplier is not satisfactory. Although the administrative manager (manager responsible for IS/IT) is concerned with the dependency on the IS/IT suppliers, there is no evidence that the firm is willing to develop IS/IT expertise in-house;
- There is low involvement of the board of directors in IS/IT issues. None of the members of the board are executives and they take a long time to make any IS/IT decision. According to the IS/IT supplier, they avoid taking risks because they are not major shareholders and are afraid of criticisms from the shareholders in case of failure;
- There is a situation of power conflict between the administrative manager and the manufacturing manager that affects IS/IT development. This is recognised by the IS/IT supplier as a significant inhibitor of IS/IT adoption and success in the firm;

In summary, the internal context has an impact on the limited use of IS/IT and makes the firm dependent from an external context that the firm is not able to manage properly. Lack of top management involvement, power conflicts and lack of IS/IT competencies were identified as relevant factors affecting IS/IT adoption and success in *FIRM 6*.

**Table 5.7 - FIRM 6: summary**

Industry	Wine industry.
Year of establishment	1964
Turnover and employees	£6.4 million and 58 employees
<b>1. Internal Context</b>	
· Organisational resources (financial and human)	The firm had financial problems in the past and IS/IT investments were affected by that. However, IS/IT costs are not seen as a major constraint to IS/IT investments. According to the software supplier, users have experience in using IS/IT.
· Management perspectives and attitudes towards IS/IT adoption.	Although it was reported that the board supported IS/IT investments, since there are many shareholders, the board avoids taking risks, and delays IS/IT decisions. According to the IS/IT supplier they are afraid of receiving criticisms from the shareholders.
· IS/IT capabilities (IS/IT people and knowledge)	The firm never had a full-time IS/IT person. There is very little IS/IT knowledge in the firm. Only one person has some IS/IT expertise.
· Organisational structure.	The shareholders of the firm are co-operatives of wine producers. The members of the board of directors are not executives and only meet in the firm once a week. The finance manager and the manufacturing manager have a major role in IS/IT development.
· Power relationships (conflicts)	Internal power conflicts between the manufacturing manager and the finance manager were reported to affect IS/IT development. Although some negative reactions to IS/IT use have occurred in the past, nowadays employees show a more positive attitude towards IS/IT use.
<b>2. External Context</b>	
<b>External support</b>	
· IS/IT vendors' support	Vendors' support is reported as technically satisfactory, but according to the finance manager they take too much time to solve problems, because IS/IT vendors lack resources.
· Consultant effectiveness	People from the software house operate also as IS/IT consultants.
<b>IS/IT available (market)</b>	
· Quality of IS/IT available in the market.	It was reported the need for better software solutions, mainly in manufacturing. However, there is low knowledge about the software available in the market.
· Quality of IS/IT external expertise & services available.	The finance manager does not have a good opinion about the IS/IT services available in the market.
<b>Business Environment</b>	Some large retailers are demanding for EDI systems and the firm is implementing those.
<b>3. Content</b>	
· Type of systems	There is a package for accounting that is complemented by a specific software to manage stocks and invoicing.
· IS/IT objectives	The main objective of IS/IT in the firm is to provide faster data processing in accounting and stock management. There is no significant strategic impact of IS/IT in the firm.
· Evaluation of IS/IT	No formal evaluation of IS/IT benefits.
· Time of IS/IT adoption	The firm uses IS/IT since the 1980s but it has low levels of IS/IT adoption.
<b>4. Process</b>	
· Stages followed in IS/IT development	Basically software acquisition. Some IS analysis has been done by the software supplier in order to adapt the software to the enterprise.
· Models & techniques used.	Software is not developed in-house. The IS/IT vendor uses some structured analysis techniques for software development.
· IS/IT training	No formal IS/IT training. "People learn by using the computer".
· People involved.	Since the members of the board are not executives, the manufacturing and the finance manager are very important in the process of IS/IT adoption. People from the software house were also involved.



## **5.8 - Case Study 7**

### **5.8.1 - Introduction: business characteristics, history and strategy**

*FIRM 7* is a textile and stamping manufacturing company, established in 1969. In 1996, turnover was £12.8m and the number of employees 340. The enterprise is 100% family-owned. There are two working owners with a share of 50% each. The owners are the widow and the daughter of the founder of the firm. The latter is the CEO and she is married to the commercial manager, an engineer, who is 35 years old and is leading the process of IS/IT development in the firm. The family also owns another textile manufacturing enterprise.

About 50% of production is exported and the remaining share of 50% is sold in the domestic market to manufacturers of cloths and home-textiles. From a finance and economic point of view, the firm is going well. However, the market is becoming unstable and, as the commercial manager says, *"being well today does not mean being well next year, the situation can easily change"*.

The struggle for survival of the Portuguese clothing industry is a major threat to the business. Competition is based on price and the enterprise is now trying to sell in Morocco and Tunisia because management believes that manufacturing enterprises in the clothing industry will move their manufacturing plants to these countries. At the same time, the firm is making agreements with large international retailers, so that these can recommend the firm to their customers, the clothing manufacturing companies.

Interviews were conducted with the commercial manager (a member of the board), the administrative manager, and an IS/IT expert (the head of the IS/IT department, that has three people). The CEO was also contacted but suggested an interview with her husband, the commercial manager, to get the perspective of the board on IS/IT adoption and use in the firm. Detailed financial statements and business reports were provided and analysed.

### **5.8.2 - Content (type of systems and objectives)**

The first PC was bought in 1983 and the process of implementing the administrative software package started in 1987. The first module to be implemented was accounting. Later, customers orders were also implemented and in 1990/91 the firm started using manufacturing applications. Hardware from Siemens-Nixdorf and a software package called *Comet Top* were bought after selecting some suppliers and getting advice from a professional that works for the firm.

Nowadays, there is a relatively old 'mainframe' with several terminals operating in character mode. The software has always been *Comet Top* but has been upgraded. This



software is used for administrative and manufacturing purposes, including sales analysis, statistics, and cost evaluation. However, the firm is now considering large IS/IT investments in a Windows NT network using an integrated software package adapted according to the specifications of the firm by a local software house. This software runs in a relational DBMS called *Progress*. The existing data on accounting and payroll will be transferred to the new computer system but manufacturing will take some time until it is transferred.

*We are going to buy an integrated management software. This software is called Piramide and it is sold by a firm that has a business relationship with us. The software is developed by them and it is some years old. It is all developed in Progress. It includes payroll, working time control, etc. We are replacing Comet with this software. In a first stage both systems will work in parallel. (IS/IT expert)*

*In terms of benefits, this new system is expected to enable IS/IT integration. Now there are some problems of integration. It has a completely different philosophy, using a database management system.... With a database management system it is easy to elaborate 'queries'. (Administrative manager)*

Since there is an IS/IT department with employing three people, there are also other IS/IT projects. CAD/CAM systems are used in stamping works. Until now customers have not suggested the use of EDI. However, the firms looks for better ways of improving business processes using IS/IT:

*I am thinking about developing a simple software that could be very useful for us and that is to put into each terminal of a salesman (some work outside and some in the firm) a program to input the data and then transfer it to the central computer. Moreover, I would like to have that information available on the Internet, where our client would be able to make the order. That information should be sorted and analysed. When salesmen go to fairs, instead of bringing a PC with them, they could use the Internet. That is viable and a practical thing. (IS/IT expert)*

### **5.8.3 - A view of success with IS/IT adoption**

According to the commercial manager, "compared to other firms in the region, this firm is, in terms of information systems, at a superior level, unusual to find". In terms of satisfaction with IS/IT (between 1, poor, and 5, excellent), he states that: "I would rate the performance of IS/IT in the firm as 4 and I want to reach 5". Furthermore, the commercial manager explains that the firm is involved in improving IS/IT:

*We reached the conclusion that the most important thing are decisions and not data collection and data processing. With little information a person may make excellent decisions. It is not necessary much information. It is necessary information, but 80% of the data is enough to make decisions in any industry. This is not difficult to get, but in order to reach the 100%, that is our target, it is complex, we must be involved in "technology wars" to get it. ...So why do we want 100%? The reason why we want*



*100% of the information is because we already have 80% and we are not satisfied with it, we want to discover the other 20%. (Commercial manager)*

According to the administrative director, *"the biggest problem today is to have the IS/IT department responding on time to our needs, response is slow now"*. In terms of satisfaction with the use of IS/IT in the firm (between 1 and 5), this manager rates the computer system as 3, *"that is why we are changing things now"*. The IS/IT manager holds a similar opinion.

#### **5.8.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)**

*FIRM 7* is a family owned-business with a functional organisational structure. The owners are the wife and the mother-in-law of the commercial manager (the top manager interviewed), who has an active role in IS/IT development.

The firm has an IS/IT department with three staff. One of them is head of the department and also an IS/IT expert, one is a systems operator, and the other is a computer programmer in Visual Basic. The commercial manager explains why the firm decided to build IS/IT capabilities in-house.

*... there was the need to buy a computer to process accounting, commercial management, manufacturing orders, etc. Hence we decided to create an IS/IT department, that was able to deal with these situations in a modern way, more efficient, faster and more feasible...global packages do not work they must be adjusted to the manufacturing specifications. Every firm has its own specifications. For administrative software, accounting, payroll, etc, they are OK, but for other systems it is not easy. (Commercial manager)*

The IS/IT expert explains that top management supports IS/IT adoption and use in the firm. However, the owners of the firm have a passive attitude towards IS/IT adoption. They delegate it to the commercial manager, a member of the family with some IS/IT expertise. The owners of the firm are not experienced IS/IT users.

*Top management supports IS/IT adoption. However, we have here two generations... That does not inhibit IS/IT development, on the contrary, there are no obstacles to IS/IT development from the older generation. She delegates those things without any constraint. (IS/IT expert)*

The commercial manager believes that, for IS/IT success, it is critical to have a leader with the "capability" to "force" the adoption and use of IS/IT. The second step is to make people use information for decision making. At the beginning, there were some initial rejections of IS/IT adoption and use but these were solved.

*The implementation of these systems created, at the beginning, some reluctance in employees, because they were used to typewriting machines, etc. However, after six*



*months, I used to say to people, 'lets go again to the typewriters' and they were answering: 'not even think about it, this is working well'. (Commercial manager)*

The IS/IT expert explains that, “people are used to have information exactly as they imagine it. They want it like that and do not accept less ... it is a thing that exists internally in the environment”.

### **5.8.5 - External Context**

About four years ago, in 1993, a consulting firm was involved in improving the information systems of the firm and according to the commercial manager he did an interesting job. His view of IS/IT suppliers was:

*Their performance is positive but not 100% positive because there are problems. The main problem they have is lack of human resources to work on projects. All these enterprises suffer from this situation. The human resources they have are scarce. (Commercial manager)*

Since there is an IS/IT department the IS/IT expert states that the firm knows well the prices and IS/IT services available in the market.

### **5.8.6 - Process**

The firm develops applications in-house but also outsources software development. The IS/IT expert (head of the IS/IT group) explains that the firm is used to developing software and only once a standard software package was bought. All the other software in the firm was developed specifically for the firm, in-house or in co-operation with a software house. He explains:

*...all our needs were fulfilled by in-house IS/IT development. We always had in-house development... It would be nice to have more people in the IS/IT department. However, it could be expensive. We also hire the IS/IT services we need, and we can be free to work in other things... ” (IS/IT expert)*

For IS/IT development, the firm uses *visual basic* and several people in the firm participate in the systems analysis phase. The IS/IT expert states that an important issue for IS/IT success in the firm is a correct analysis and definition of needs, then the introduction of data must be controlled, and this is being done. In his opinion, standard packages do not work well.

*We selected Progress because the application that was presented to us, after an analysis of the ratio price/quality, is good and there is a guarantee. There are also other reasons, we can not have standard software. They have a standard package but we need to do some changes. ...We also bought the source code. To keep the source code is essential, otherwise we would be too much dependent on them. (IS/IT expert)*

IS/IT training was provided, with funding from a European project.



*We had IS/IT training, financed by European funds, in 1992. We trained many users then. When we expanded our network, we trained people to use the central computer system and to use some programs common by that time, like Lotus 1-2-3, Word, etc. They learnt how to use a word processor and spreadsheet and how to use Comet Top.*  
(Commercial manager)

#### **5.8.7 - Discussion of the significant factors**

The following factors were identified as related to IS/IT adoption and success in the enterprise:

- The commercial manager is leading, at a top management level, IS/IT adoption and use. Since he is a close relative of the owners he has power inside the organisation and he is willing to make IS/IT investments;
- IS/IT is perceived as strategically important for the firm and IS/IT costs are not seen as a constraint to IS/IT adoption;
- The firm has developed IS/IT competencies in-house. There is a computer centre with three IS/IT staff. IS/IT expertise was developed in-house because managers are of the opinion that IS/IT vendors have scarce resources to develop software and provide IS/IT technical support.
- The manufacturing software, although provided by an independent software house, was designed to fit the requirements of the business. The IS/IT professionals of the firm co-operate with the IS/IT suppliers in software development;
- The firm owns the source code of the software applications developed by external software houses. This enables the firm to make changes in those applications and be strategically less dependent on the IS/IT suppliers.
- Users have an important role in IS/IT success by being very demanding. Since the firm has developed IS/IT competencies in-house, users are used to having specific software for their tasks.

Although the firm outsources the development of some computer applications in order to have the IS/IT staff allocated to other tasks, the internal context plays a critical role in IS/IT development. The availability of IS/IT competencies in-house enables the firm to control and evaluate the performance of those suppliers and co-operate with them in software development. On the other hand, software changes, done in-house, allow the enterprise to get applications completely fitted to the requirements of the business.

**Table 5.8 - *FIRM 7*: summary**

Industry	Textile industry (stamping).
Year of establishment	1969
Turnover and employees	£12.8 million and 340 employees
<b>1. Internal Context</b>	
• Organisational resources (financial and human)	From a financial perspective the firm is in a comfortable situation. Financial resources are not perceived as an inhibitor of IS/IT adoption. There were some references to lack of use of information for decision making by managers due to low expertise using IS/IT.
• Management perspectives and attitudes towards IS/IT adoption.	The owners of the firm have a passive attitude towards IS/IT adoption. They delegate it on the commercial manager, a close family member with some IS/IT expertise. The commercial manager is of the opinion that for IS/IT success it is critical to have a leader able to manage the process of IS/IT the adoption and use.
• IS/IT capabilities (IS/IT people and knowledge)	Software is developed in-house. There is a computer centre with three IT staff.
• Organisational structure.	Functional structure. Family owned business. The owners are the wife and the mother-in-law of the commercial manager (the top manager interviewed), who has an active role in IS/IT development. The IT person is not involved in business decision making.
• Power relationships (conflicts)	Some initial rejection to IS/IT adoption, resolved over time.
<b>2. External Context</b>	
External support	
• IS/IT vendors' support	There is the perspective that the performance of IS/IT vendors is good but not 100%. IS/IT suppliers have scarce human resources to work in IS/IT projects.
• Consultant effectiveness	Not reported as a relevant issue.
IS/IT available (market)	
• Quality of IS/IT available in the market.	There is the perspective that software for manufacturing needs to be adapted to the specifications of the firm.
• Quality of IS/IT external expertise & services available.	Not reported as a relevant issue.
Business Environment	Not identified. According to a top manager, the firm works with products that may change everyday and that makes it difficult to adopt EDI based systems.
<b>3. Content</b>	
• Type of systems	The firm is preparing a large IS/IT investment: a Windows NT network using an integrated software package adapted by a local software house according to the specifications of the firm. Actually, there is an old central system with several terminals operating in character mode, for administrative and manufacturing purposes.
• IS/IT objectives	Provide accurate information about: sales analysis; statistics; cost evaluation.
• Evaluation of IS/IT	No formal evaluation of IS/IT benefits.
• Time of IS/IT adoption	First PC in 1983. In 1986, the central computer system was installed (administrative applications), and manufacturing orders were included in 1991.
<b>4. Process</b>	
• Stages followed in IS/IT development	Software acquisition is the dominant phase although some minor applications are developed in-house.
• Models & techniques used.	No formal techniques used by IS/IT people in the firm. Visual Basic used to develop applications in-house.
• IS/IT training	IS/IT training provided, in 1992, with funds from an European project.
• People involved.	Key people: commercial manager, IT people, IS/IT experts from the software house.



## **5.9 - Case Study 8**

### **5.9.1 - Introduction: business characteristics, history and strategy.**

*FIRM 8* is a footwear firm with 250 employees and £6m turnover. The firm started operating in 1959 and has three owners: the CEO, his brother and a nephew. The firm sells its own brand name in the domestic market but usually exports under the customer's brand. Exports represent 95% of production (around 40% is sold in the UK). Customers frequently define the design of the shoes they purchase.

There is a strategy of reducing costs and increasing quality because profit margins are low. The firm is in a good economical situation and puts pressure on suppliers for fast delivery of raw materials in order to enable quick response. A new manufacturing plant and office building were recently bought and the firm started to install an integrated computer-based information system for manufacturing.

In order to collect data, the CEO, the finance manager, an IS/IT expert, and one external IS/IT supplier were interviewed.

### **5.9.2 - Content (type of systems and objectives)**

The firm purchased, from a local software house, a software package that was specifically designed for the footwear industry. This software includes MRP features and is being installed and adapted to the requirements of the firm. Another footwear manufacturer (see case 11) is also using the software. The main objective of the software, which runs in a Unix server, is to provide accurate information about manufacturing costs.

As the finance manager pointed it out, the enterprise is having problems integrating the software modules. This was even more difficult after the changes made in the source code of the programs. Since the new manufacturing software is not fully operational yet, the firm is still using some applications previously developed in-house by an employee that has some IS/IT expertise. In the administrative department, people use an accounting package from *Infologia*. There are no links between administrative and manufacturing applications, neither are these links seen as important. CAD/CAM is also used in the firm and managers interviewed believe it was a good investment the firm made.

### **5.9.3 - A view of success with IS/IT adoption and use**

While administrative systems work well, there have been several problems with the implementation and use of the manufacturing software. Both the finance manager and

the software vendor reveal low levels of satisfaction with its performance. They argue that neither the employees nor the top management made an effort to make the system work.

The project started several years ago and major objectives are not yet achieved. The software vendor also states that the implementation of the software is too much behind schedule, and that people are not committed to make the system work.

*Since we started the implementation of the system in FIRM 8, I have already installed it in 3 or 4 other manufacturing firms that are already working with it. (IS/IT vendor)*

Although the IS/IT person defines his level of satisfaction with IS/IT in the firm as a 3 (between 1, poor and 5, excellent), he recognises that there are significant delays in the process of implementing MRP.

*In my opinion, the way this new software is being implemented is the right one. However, the accomplishment of the objectives is taken too long, it is not working at 70%.... (IS/IT expert)*

From the interviewees, the CEO is the only one that has a clear positive opinion about IS/IT adoption and use in the enterprise: *"IS/IT in this firm is having an excellent performance. I would rate it as 5 (between 1 and 5)...We do not have problems. The problem is going slowly. If we wanted, we can put another employee there and make it work"* (CEO).

#### **5.9.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)**

The CEO is 71 years old and has no IS/IT expertise. The finance manager is 28, holds a first degree in economics, and is the IS/IT *project champion* in the firm. Because of its small size the finance manager also gets involved in other tasks: *"I am the first economist that ever worked for this firm...I am also involved in manufacturing control. There is an engineer in manufacturing but I co-operate with him. We both tried to computerise manufacturing control."* (Financial manager)

There are several relatives of the owners working in the firm. In spite of that, communication amongst people is not always efficient and the IS/IT supplier argues this is one of the reasons why the manufacturing system does not work well.

The firm invested in the current hardware and software around £ 40,000. The finance manager is of the opinion that IS/IT investments are expensive but he states that *"it was expected that a significant part of the investment would be financed by bank loans, but later it was noticed that it would not be necessary to have bank loans"*. The CEO does not see IS/IT costs as significant for the firm: *"nowadays, IS/IT is not very expensive. It*



*is possible to buy PCs slowly, first you buy two, three, four and you keep buying according to your will and financial resources” (CEO).*

The CEO recognises that many employees had not adapted to IS/IT as he would like them to. The finance manager also confirms that some people have problems using IS/IT because of their low education.

*If employees are reasonably good employees it is possible to implement a manufacturing control system, otherwise things will be difficult ...People in the production line must pay attention. In manufacturing there is a large amount of employees that know well their work but are not good working with their brains.” (CEO)*

*The problem I had was to make people with low education use the computer. I tried to put young people working with the computer, people more educated. At the moment, I have in each section a person able to use the program. (Finance manager)*

FIRM 8 has an employee providing IS/IT support part-time. He learnt computer programming on a course and also got some IS/IT experience in the army. There are some programs running in the firm that were developed by him. The finance manager states that it is important for the firm to have an IS/IT expert.

The IS/IT person is not working full-time in IT, he is also responsible for exports. On the other hand, his interest is developing all the software of FIRM 8 in-house.

*I would like to work only in IS/IT, to have an office and develop IS/IT applications. ... In my opinion, we should have developed software in-house. Since there was a project and we needed another application that was defined in the project, we should have tried to develop it from that application done here, with many requirements suggested by us. (IS/IT expert)*

The IS/IT supplier sees the view of the IS/IT expert of the firm as a problem.

*The role of the IT person in FIRM 8 was not programming. However, his wish is that, to make only software. I know that, 2 or 3 years ago, his objective was to develop the manufacturing software of FIRM 8. He wanted to do everything. That was also a problem. (IS/IT vendor)*

Both the CEO and the finance manager report that because it is easy to find a job in the industry, employees do not make much effort to use the software system.

*If you say to a blue collar worker that he must be more careful, that he can not do this and that, you tell him this twice or three times, he gets annoyed and goes to another factory. Since there are no problems with getting a job in this industry, people are not much interested in using IT. (CEO)*

*At the beginning, people did not react well to IS/IT. They felt they were being controlled. That was the first reaction. After IS/IT training, people started to*



*understand better what the system was and that the objective was not to control people, but materials, to control what is in the warehouse and not to control people...People have an important role in this process of change. Since there is no unemployment, employees do not care much. If one wants to leave our firm because he is bothered with what he has been doing, in the following day he will have a job. There is no problem.* (Finance manager)

The CEO was never involved in IS/IT adoption because he does not have much expertise. The CEO does not understand why computer systems need to be upgraded so fast. On the other hand, the finance manager, who led the process of IS/IT adoption and use, was new in the firm and did not have much power to make things work. As he explains:

*It was very difficult for me, mainly because I was also new in the firm. I was new and introducing new methods...* (Finance manager)

The owners of the firm are not much involved in the process of IS/IT adoption and use. Several statements gathered in the interviews confirm that.

*The top managers (the owners of the firm), since they are elderly people, they are not IS/IT users. They delegated that task to me and to the IS/IT person. Off course, they did not get personally involved. The top managers of this firm are receptive to new manufacturing technologies but not so much to IS/IT.* (Finance manager)

*...owners have a passive attitude towards IS/IT adoption. Once in a while, they arrange a meeting, they ask how things are going but I believe that it is not enough. Our software is working in a dozen other firms and hence it should work there too...It is also important to have motivation from the top to the bottom. When there is someone in the board of directors saying: 'No. This must be done through the use of IS/IT', it makes things happen, and reinforces the use of IS/IT by employees.* (IS/IT vendor)

The IS/IT person emphasises the influence of the finance manager as project leader (considering him as a top manager) by saying that:

*It is a big difference between top management now and 6 or 7 years ago (I am here since 10 years ago). Before, there was a strong 'rowing against the tide' in order to show that computers were useful.* (IS/IT expert)

Lack of co-operation amongst people is pointed out by the IS/IT vendor as a relevant factor inhibiting IS/IT adoption and use.

*In many factories people do not easily co-operate, they try to protect their own activity, making it secret. When an information system comes in, there is a revolution because it will affect privileges and information will be available for any one. The person responsible for the warehouse was the expert on leather, but now anyone can be expert on leather, to know what prices are, the suppliers, etc. Hence people are afraid of losing importance and prestige in the firm, and there are some negative reactions. FIRM 8 is a typical case where people do not co-operate, working together is extremely difficult...The human factor is very important, people have to justify their*



*performance and their salary. The human factor and that resistance to change is very important. In FIRM 8 we can find this a lot. (IS/IT supplier)*

Furthermore, the IS/IT supplier states that although he sees the problem, he may lose the client if he puts too much pressure on the firm to solve the problem. The result can be even worse, he is afraid of being seen by the owners as the person responsible for IS/IT failure. Since he operates in a local market, where almost all top managers/owners know each other well, he might lose potential clients.

*There is no team effort. There are 2 or 3 people trying to make it work but that is not enough... I do not win anything by understanding this because it does not solve the problem. The only thing I can do is motivate people and once in a while I ask: "Is the 'technical file' already inputted? And stocks? Raw-materials?, etc. (IS/IT vendor)*

### **5.9.5 - External Context**

Vendors' support is perceived by the interviewees as good and the firm never hired IS/IT consultants. The IS/IT vendor says that people from the software house are the IS/IT consultants of the firm, although they do not charge for that. The IS/IT expert of FIRM 8 states that there is in the market better software for manufacturing, but the one the firm uses was already adapted to the footwear industry and was not expensive. On the other hand, this software was initially developed for another footwear enterprise and implemented with success. The CEO of FIRM 8 is also a very close friend of one of the owners of this other footwear firm and that also influenced the choice.

### **5.9.6 - Process**

The finance manager is the IS/IT project champion, he is leading the process of IS/IT adoption and use in the firm in co-operation with the people from the software house. The CEO, although providing support, does not get personally involved. On the other hand, the internal IS/IT expertise is not interested in the success of the new manufacturing software because he would like to be the one in charge of IS/IT development in the firm. However, when asked about how he would solve the problems with the adoption of IS/IT in the firm, he clearly explains that:

*In my opinion, the first thing to do was to have me developing software full-time. A firm the size of this one needs a person or two doing only that and obviously showing results. Second, to renew some computers we have in the network. Third, to convince top management to support IS/IT. Bosses want to see trucks full of shoes for customers, but to look at a computer screen is ignored. There is lack of sensitivity. It was worse before but the problem still exists. (IS/IT expert)*

On the other hand, the IS/IT vendor argues that the software was developed using a relational DBMS (Informix 4GL) and that in order to get quality it is necessary to have a development team with several people, sharing knowledge about different technologies,



such as, operating systems, and networks. In his opinion it is unlikely that the IS/IT expert is able to develop a similar software product in-house.

IS/IT training to use the manufacturing software took more than one year and a part of it was funding with money from an European project. Participants were operational managers and some top managers. However, the finance manager says that top managers don't use that knowledge. The IS/IT vendor also reveals that there was lack of commitment from the top management in the implementation of computer-based information systems in the organisation.

The adaptation of the manufacturing software to the manufacturing processes is taking too long because employees are not co-operating. There are meetings with people responsible for each section and people are told about what should be done in the next 15 days. Top management was formally supporting that, but they did not get personally involved, they did not participate.

#### **5.9.7 - Discussion of the significant factors**

An integrated software system, developed by an external software house has been implemented in the firm, however not successfully. Although the CEO is of the opinion that IS/IT is been successfully adopted and used in the organisation, all the other interviewees reported significant problems with the process of IS/IT adoption and use. The key factors related to the assessed levels of IS/IT adoption and success are:

- The CEO is an elderly person, he does not have any knowledge or experience in IS/IT, and does not get involved in the process of IS/IT adoption and use in the firm;
- Since top management is not involved in the process of IS/IT adoption and use, users (even managers) show resistance to change and do not use the new manufacturing software. First, they avoid sharing their knowledge about manufacturing processes. Second, since they do not have much IS/IT experience, they avoid using the system because they are afraid of making errors;
- The finance manager has been the *IS/IT project champion* but is relatively young and new in the firm. As a consequence, he does not have the necessary power to put pressure on the users to start using the software, also because several users are relatives of the owners;
- The firm is a traditional enterprise and there is a significant power distance between the finance/IS/IT manager and the CEO. The CEO is unaware of some of the existing problems with the adoption and use of the manufacturing software;



- Since it is not difficult to find a job in the local footwear industry, managers believe that if they exert too much pressure on employees they may leave the enterprise;
- The firm has an employee with some programming skills. This person is disappointed because he would like to develop all the applications of the firm. He sees the software house as a competitor.
- The IS/IT manager/expert of the software house finds little support in the enterprise and he avoids exerting pressure on employees to use IS/IT, leaving that task to the finance manager. He is afraid that it may have a negative impact on him. Users may start blaming him for the failure of the system and because the CEO can not evaluate why the system does not work, his reputation in the local industry would be affected. This could make him lose other potential clients.
- The IS/IT vendor argues that the business processes of the enterprise are spread out across several people and because there is not a good relationship amongst employees, information is lost.

There is in the firm an internal context that does not enable IS/IT success. The CEO is not involved in IS/IT adoption and use, users show resistance to use IS/IT, and the finance/IS/IT manager has insufficient power in organisation to lead the process of IS/IT adoption properly. Moreover, the firm has an employee with IS/IT expertise that is frustrated because he would like to develop the software of the firm. The IS/IT supplier has a passive attitude because he believes that, within this context, there is nothing he can do besides keeping the finance manager informed of the situation.

**Table 5.9 - *FIRM 8*: summary**

Industry	Footwear industry.
Year of establishment	1959
Turnover and employees	£6 million and 250 employees
<b>1. Internal Context</b>	
• Organisational resources (financial and human)	The financial situation of the firm is good. The firm has been profitable and is one of the best in the footwear industry. However, finance resources are seen as an inhibitor of IS/IT adoption (limited budget). Users have low levels of education and are not committed enough to use IS/IT in their tasks.
• Management perspectives and attitudes towards IS/IT adoption.	There is a conflict of perspectives. The finance manager supports the use of IS/IT in the firm. However, the firm is a traditional family business, the entrepreneurs/owners are not young (the CEO is 71 years old) and are not committed to IS/IT adoption. Therefore, it has been difficult to implement IS/IT.
• IS/IT capabilities (IS/IT people and knowledge)	There is a computer programmer that helps to solve IT problems but does not work full-time in IS/IT. He is also in charge of transportation and logistics. This person aspires to working only in software development.
• Organisational structure.	Family business with a functional structure and informal relationships. The CEO and his brother are the owners of the firm. Almost all managers and administrative staff are family members. No formal IT department/office.
• Power relationships (conflicts)	Some interviewees are of the opinion that people are not committed enough to IS/IT adoption, as a reflex of owners' attitude of not giving much importance to IS/IT. Employees may fear losing their competencies.
<b>2. External Context</b>	
<b>External support</b>	
• IS/IT vendors' support	Satisfied with vendor's support.
• Consultant effectiveness	No use of IS/IT consultants.
<b>IS/IT available (market)</b>	
• Quality of IS/IT available in the market.	According to the IT person, there is good software available, but manufacturing software always needs to be adapted.
• Quality of IS/IT external expertise & services available.	Not reported as a relevant issue.
<b>Business Environment</b>	Customers never suggested the use of interorganisational information systems.
<b>3. Content</b>	
• Type of systems	Accounting package, manufacturing modelling and planning (developed in-house). A software developed by a software house will replace the existing manufacturing application.
• IS/IT objectives	Reducing and evaluating manufacturing costs.
• Evaluation of IS/IT	No formal evaluation of IS/IT benefits.
• Time of IS/IT adoption	Late adopter.
<b>4. Process</b>	
• Stages followed in IS/IT development	Software acquisition is the major phase.
• Models & techniques used.	No formal analysis and design techniques. Some code was developed in Fox.
• IS/IT training	Funds from an European project were used for IS/IT training (for more than 1 year, a 605 hours course).
• People involved.	Key people: finance manager, software house experts.



## **5.10 - Case Study 9**

### **5.10.1 - Introduction: firm's characteristics, history and business strategy**

*FIRM 9* is a traditional, family owned, Portuguese wine manufacturer, founded in 1834. By the end of 1996, the firm had about 165 employees and generated £20 million turnover. The enterprise makes a wide range of medium and high quality white, *rosé* and red wines, under some well-known brands. About 50% of the production is exported, to Europe and the USA (low price *rosé* wine). Superior quality wines are mainly sold in the domestic market. The firm competes on price for common wines but also offers high quality (high perceived use value) at higher prices.

Since the manufacturing plant did not have enough capacity to satisfy the demand for *rosé* wine in the American market, a new manufacturing enterprise, was established in 1973, in a joint-venture with a foreign enterprise. In 1985, this enterprise (that will be referred to as *INTERWINES*) was sold to IDV, a large multinational company operating in the wine and drinks industry. In 1996, for strategic reasons, the multinational company decided to sell *INTERWINES* and *FIRM 9* bought it. Now, from a legal perspective, there are two different firms sharing the same buildings and equipment, owned and managed by the same people. In terms of the research they will be analysed as one.

*FIRM 9* is a 100% family-owned business. The CEO and his brother are the major owners, each holding, with their families, 50% of the enterprise. The corporate strategy is oriented more to survival than to generate profits in the short term. According to the finance manager, the owners do not depend on the firm for a living and they do not invest in businesses outside the wine industry, even if those businesses look profitable. In his opinion, the firm is managed more in the sense of a "family hobby" that the family is proud of and does not want it to die. The CEO also expresses this idea by saying that:

*We have launched many wine brands and we are not here to sell capital that took so many years to build. I am the 6th generation and my sons, who are already shareholders of the firm, are the 7th generation. (CEO)*

Five people were interviewed: the CEO, the manufacturing manager (also a member of the board of directors), the finance manager (and manager responsible for IS/IT), an IS/IT expert (from the IT department), and an IS/IT expert (from an external software supplier). Commercial reports and documents about the technical features of the software installed in the enterprise (*Decisor* and *MFG/PRO*) were collected and analysed.



### **5.10.2 - Content (type of systems and objectives)**

The adoption of IS/IT in *FIRM 9* started in the early 1980s, initially by using PCs to automate a few tasks. Later, a minicomputer system with seven terminals was installed using some standard administrative software. In 1989, a local software house was contacted and an integrated packaged was adopted and changed according to the specifications of the enterprise. This software was running on a PC network, using a 486 microcomputer as server. It operated in the firm from 1992 until 1996. However, the manufacturing module was never installed, the system was used only for typical administrative purposes, such as, accounting, invoicing, stocks, and human resource management. Hardware and IS/IT training were financed through European funding.

In September 1993, *INTERWINES* installed a more complex integrated software packaged called MFG/PRO. MFG/PRO was developed by an American company and is described by the financial & IS/IT manager as *"a global system that supports manufacturing, maintenance and also the administrative area"*. The adoption of this package was the result of a global IS/IT policy of the multinational company that wanted to have similar software in all the enterprises of the group.

In 1996, *INTERWINES* was bought and integrated in *FIRM 9* and there was a need to have a common IS/IT infrastructure. After some discussion, it was decided to use the MFG/PRO software supported by a computer network based on an HP 9000 server with about 50 PCs operating as system terminals. The HP 9000 server has a RISC processor and runs a Unix operating system from Hewlett Packard (HP UX). There are also two other net servers: one for Microsoft Office applications and one for tests, and as a backup for the main one if any serious problem occurs.

According to the managers interviewed, the use of IS/IT in the firm led to several improvements in business operations like better stock control and financial analysis. However, there were never defined prior specific objectives to be achieved by IS/IT adoption and use. Neither do they have any IS/IT evaluation procedure.

### **5.10.3 - A view of success with IS/IT adoption and use**

The performance of IS/IT is recognised by most interviewees as weak and far from satisfactory. The finance manager (also the person responsible for IS/IT) explains his level of satisfaction with the MFG/PRO system by saying that:

*I am used to say that now I have a Rolls Royce but I only use the first gear. The system cost about 80 million escudos (£320,000) and the situation is a joke... In fact, MFG/PRO is powerful but, I have no doubts, to do what we do, 8 million escudos (£32,000) would have been enough. (Finance & IS/IT manager)*



*The MFG/PRO is an American system and it does not fit our needs in terms of administrative work. It has plenty of problems... If someone comes here and asks for a balance sheet he will be lost. Even me, I am not able to get a financial statement with this system. (Finance & IS/IT manager)*

Furthermore, when asked to quantify his level of satisfaction with the performance of IS/IT in the firm, from 1 (poor) to 5 (excellent), the finance manager showed low level of satisfaction with IS/IT:

*I consider the performance of IS/IT in the firm to be 2, with some good will, otherwise it would be 1. There are many things that must be improved. The computer system in terms of potential I think is worth 4, but in terms of use it is worth 2. (Finance & IS/IT manager)*

Both the leader of the IS/IT department and the manufacturing manager have similar opinions, clearly expressing low levels of IS/IT satisfaction:

*In terms of satisfaction with IS/IT performance, in terms of information availability in MFG/PRO, in a global sense, I would say 4, but according to the information that is available for the right people at the right time I would say 2. (IS/IT expert)*

*I would classify the computer system in terms of user satisfaction between 2 and 3. If you ask me why between 2 and 3, I would say that this is more because of firm's capability to use the computer system than because of the computer system itself. In terms of potential the system should be rated 4. (Manufacturing manager)*

The administrative software module was designed according to the rules of American accounting and does not fit the Portuguese norms. The finance manager was disappointed because he had to give up using the previous software (*Decisor*) which met his needs. The finance manager explains that he decided to sacrifice the administrative area to avoid protests from the manufacturing people. However, most manufacturing routines available in the software package are not used. On the other hand, the manufacturing manager demands IS/IT training, demand that it is not satisfied by the finance & IS/IT manager because IS/IT resources are scarce. The finance & IS/IT manager is of the opinion that manufacturing people should first start learning by themselves how to use the software.

*The system enables manufacturing control in real time, but they do not use it. That is an important issue here. They think I have to get someone to give them IS/IT education. I believe that I do not have to get someone at the moment. They are chiefs, managers and they must look at the manuals and see what they want, what they need, and then I will find an expert to teach them. (Finance & IT manager)*

Although the CEO recognises that the MFG/PRO is not being properly explored in the enterprise, compared with the other interviewees he shows higher levels of satisfaction with IS/IT. In fact, the CEO was the only interviewee that evaluated positively the performance of the computer system.



*About the performance of IS/IT, globally, I would say it is almost 4 and I want it to be 5 (between 1 and 5). (CEO)*

Furthermore, the CEO's low IS/IT knowledge is likely to influence his evaluation of IS/IT performance and restrict a deeper understanding of the reality related to IS/IT adoption and use in the enterprise.

*I am the only person here that never started learning how to use computers, because of lack of time, and I need to be near someone when I want to use the computer. (CEO)*

Nevertheless the CEO perceives the need to improve the performance of the computer system and is willing to invest in it.

*There is a huge list of software projects to be developed by our own IT department. There are 30 or 40 things that they need to do in order to improve our information system. It is the improvement of the quality of the firm based on IS/IT sophistication. (CEO)*

#### **5.10.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)**

The firm has a common functional structure, with the board of directors on the top. The IT department has two experts and the person responsible for IS/IT is the finance manager, a top manager of the firm, although not a member of the board. The board of directors includes three executives: the CEO (who holds a University degree in management), the vice-president (the CEO's brother), and the manufacturing manager, an agricultural engineer that has been in the enterprise for 25 years.

In *FIRM 9* the finance & IS/IT manager as well as the manufacturing manager have a major role conducting IS/IT investments. The finance manager is the person responsible for IS/IT and according to him the finance department plays a crucial role in the firm: "*if the finance department says no to an investment it will not be done*". On the other hand, manufacturing is the core business of the enterprise. The finance & IS/IT manager does not have expertise in manufacturing and the opinion of the manufacturing manager is critical for IS/IT development. Furthermore, the manufacturing manager holds a higher hierarchical position in the organisational structure, being a member of the board of directors.

The CEO has low IS/IT expertise and does not get much involved in IS/IT development. The finance manager also mentioned that "*IS/IT decisions are taken more by managers than by the board of directors*".

Although the enterprise is not in a very good financial situation due to large investments because of the acquisition of *INTERWINES*, it was reported that it has easy access to bank loans: "*we have a very good image and they (banks) never put up any obstacles,*



*we never show any warranty, it is even forbidden to talk about warranties (for bank loans)". Cost was never seen as a constraint for IS/IT adoption. FIRM 9 has been investing large amounts of money in IS/IT. As the finance manager says: "cost is not an inhibitor of IS/IT development. We are willing to pay if the new system provides the information we need". The MFG/PRO software cost about £300,000, a relatively large investment for a manufacturing SME.*

It was reported that employees have a lack of IS/IT knowledge and more IS/IT training is needed. According to an IS/IT expert, one of the reasons for not implementing MRP is exactly this lack of IS/IT expertise of some employees.

*When we will start with MRP we must be sure that people who will use MRP are able to use it. MRP is not a very complex thing but there are people in the warehouse that have 'too large fingers'. (IS/IT expert)*

The development of IS/IT capabilities is recent in the enterprise and occurred more as the result of trying to correct errors done in the past. The firm has now two IT people, one hired in 1994 and the other in 1997. When the firm installed the integrated software package MFG/PRO there was a lack of internal IS/IT expertise to adapt the software to the specifications of the firm.

This lack of IS/IT knowledge was also previously noticed in the implementation of the package *Decisor* in *FIRM 9*, and later in the use of the package MFG/PRO in *INTERWINES*. Moreover, the manufacturing manager declares that one important reason why there are low levels of satisfaction with MFG/PRO is the lack of IS/IT internal expertise.

*We also made a mistake that was not having anyone in IS/IT. We did not have, from the beginning, an IS/IT person. (Manufacturing manager)*

MFG/PRO, although recognised by all interviewees as a very powerful system, must be adapted to the specifications of the enterprise. However, neither the IS/IT expert nor the software vendor were able to develop new code for the product.

*MFG/PRO is, in my opinion, a very flexible package. Nevertheless, flexibility depends a lot on people. The package allows several levels of adaptations, different reports, but they must be programmed. They are not born there! (Manufacturing manager)*

On the other side, there is also a lack of management capability in managing the process of IS/IT adoption and use. The CEO has low IS/IT knowledge which affects his role in making decisions about IS/IT.

The CEO was never much involved in processes of IS/IT adoption. The manufacturing manager and the finance & IS/IT manager are the key management people in the organisation to guide IS/IT development. Nevertheless, these managers have different



opinions about IS/IT adoption in the firm. The finance & IS/IT manager preferred to use the previous software system (*Decisor*), that was more suitable for administrative purposes. However, he decided to accept the use of MFG/PRO, in order to avoid further conflicts.

*I decided to sacrifice the administrative area in order to avoid complaints from manufacturing people. (Finance & IS/IT manager)*

It was reported that sometimes users show a passive attitude towards IS/IT adoption. The manufacturing manager reveals that often data are not input into the computer system because employees know it will not be used. The finance & IS/IT manager also criticises the attitudes of manufacturing people towards IS/IT use:

*People in the manufacturing plant were not avoiding the system but they expected me to force them to use it. People got used to specific operation procedures and those last ten years, although they represent more work, less efficiency, etc. (Finance & IS/IT manager)*

The manufacturing manager approaches this problem by arguing that:

*The implementation of a computer system requires the adaptation of operations in the firm, re-structuring operations in the firm. Otherwise, no firm will survive to the implementation of IS/IT and huge conflicts will appear. (Manufacturing manager)*

There was an evident lack of co-operation among managers due to disagreements about the way IS/IT has been adopted by the organisation. These differences of opinion also affect the development of IS/IT training and skills in the firm.

*It is the board saying one thing and me another. I do not provide these services (IS/IT training) because the people that I have that could do that have other things to do rather than teaching them. They must learn the basics by themselves. (Finance & IS/IT manager)*

The differences of opinion about IS/IT development in the enterprise generated some internal conflicts and lack of a clear IS/IT strategic orientation. Management conflicts related to IS/IT adoption are also affected by lack of leadership from the CEO in IS/IT matters. The CEO, although not giving too much importance to it, describes the existence of some of those conflicts:

*Each time we make changes in an enterprise there are always conflicts. That is why there is a board of directors here - to manage conflicts. There are conflicts because everyone in the other departments tend to say: 'Well, that? It must be done by the IT department. No, that must be given to the IT department, etc. (CEO)*

Since information available on the computer system has not been used by management, employees do not care much about inputting data.



*We even had more data in the computer system before than we have now. Since management does not use that data, people started to simplify their inputs into the computer system. People do not input data into the computer because they know that there are no consequences from not inputting data. (Manufacturing manager)*

#### **5.10.5 - External Context**

One of the reasons the implementation of MFG/PRO failed was due to a lack of external support. The product has poor technical assistance in Portugal, explained by the fact that this software is not frequently sold in Portugal, although there are some other firms using it. One of the IT experts explains that.

*The package has big problems in terms of support. When we started, there was a firm in Portugal distributing the product that had financial problems and closed. Their knowledge of the package was very weak. (IT expert)*

Local technical support was poor and the enterprise tried to get technical support from abroad. This support was difficult to get and became a very expensive solution. From the perspective of the American software house that developed MFG/PRO, the Portuguese local agent should be the one providing technical assistance.

*We had problems because the distribution of MFG/PRO in Portugal was given to a firm that was fighting to be responsible for technical assistance but they were not capable. QAD (the firm that developed the software) had an agreement with this firm and did not want to interfere in the Portuguese market. It was necessary to make a lot of effort in order to get direct access to an international IS/IT enterprise that was commercialising the software. That was one of the greatest problems we had... That was a big problem for us. From the moment the local agent was out and we had direct access to foreign technical assistance some of the problems were solved in one or two weeks. (Manufacturing manager)*

Managers soon realised that the firm should have developed IS/IT expertise in-house in order to improve the use of MFG/PRO.

*It is essential that there is a person here that knows the software well. The MFG/PRO people knew a little bit about warehousing and finance but they knew nothing about manufacturing. Hence this period has been painful for us. (Manufacturing manager)*

*The package is good, but support is difficult...if I call someone from Belgium or Barcelona, mainly from Belgium, they are very good but it is expensive. Having local support will help us a lot. (IT expert)*

Later, the decision of selecting MFG/PRO was questioned even by the manufacturing manager.

*We chose MFG/PRO because we were a multinational company. If I had to choose now, I would select a software that was able to fill my requirements but I would give a*



*similar level of importance to a good technical assistance in Portugal. (Manufacturing manager)*

It was reported that while good administrative software is easy to find, for manufacturing systems it is necessary to develop proprietary software or to adapt existing packages according to the specifications of the enterprise.

The quality of the MFG/PRO package was never questioned. All interviewees see it as a powerful software system. Problems happened adapting the software package to the requirements of the enterprise.

The interviewees did not report in the firm any pressure from customers to adopt IS/IT. Although the firm sells to large retail stores, these haven't put any pressure on the firm to use EDI or other IT systems.

#### **5.10.6 - Process**

A steering committee was created in order to enable the implementation of MFG/PRO. That committee was headed by the manufacturing manager and included a person from each functional area, plus the European IS/IT manager of IDV (a shareholder of *INTERWINES*), a consultant from KPMG, and people from the local agent representing MFG/PRO in Portugal.

However, there were some problems. According to the manufacturing manager and leader of that steering committee, the facilitator from KPMG knew very little about MFG/PRO, he was more an expert in management, and people from the local software firm representing MFG/PRO did not know much about the software either. That was the reason why, after having problems, a foreign MFG/PRO expert was hired in order to provide technical support. In *INTERWINES* there was only one IS/IT expert, hired in 1994, some months after the installation started, but he did not know anything about MFG/PRO.

The firm does not develop software in-house except small programs. Most software is acquired from software houses. The major role of IS/IT people has been administrating the computer network. There is no benefits management approach and the IS/IT expert does not even believe in it:

*To quantify benefits is difficult. Some numbers are usually guessed when one thinks that something is good for the firm and should be quantified as an objective. I have never seen a serious and honest proposal with quantifiable IS/IT benefits and that those benefits were achieved. (IS/IT expert)*

Since there is little in-house development, there are few references to techniques or frameworks used. However, the software house supplier of *Decisor* mentions the use of analysis, design and coding techniques and tools, mainly based on SSADM and fourth



generation languages. Their people also reported some problems in getting the information they need in order to customise the software. The MFG/PRO software was developed in Progress, a relational DBMS (data base management system). The fact that new releases of MFG/PRO will come soon in Oracle (a more common relational DBMS) is positively seen by the finance & IS/IT manager.

There are different opinions about user training in the firm. The finance & IS/IT manager argues that users must first start learning by themselves how to use the software and only after that they should attend IS/IT courses or demand for IT help desk services.

*People must be curious, they must want to learn. After that they may ask for computer education. The top manager in manufacturing is a member of the board. He tells me to find someone to provide computer training but I keep tell him that I will not, because I do not agree with it. I think that it is a mistake, they won't learn... It is the board saying one thing and me another. I do not provide this service because the people that I have that could do that have other things to do rather than teaching them. They must learn the basics by themselves. (Finance & IS/IT manager)*

#### **5.10.7 - Discussion of the significant factors**

From the analysis of the case, several issues emerged related to the low level of satisfaction, reported by most interviewees, with the adoption and use of MFG/PRO, the integrated software package recently implemented in the enterprise:

- The MFG/PRO software was developed by an American software house and does not fit the legal requirements of Portuguese accounting.
- The manufacturing module is not being used properly because the firm does not have expertise to adapt the software to its manufacturing processes.
- The Portuguese local agent representing MFG/PRO did not know the software well and the international software house that developed the product did not want to provide technical support, arguing that this role should be performed by their Portuguese partner. Foreign technical support later provided, after exerting pressure on the software house, was too expensive.
- The CEO does not have IS/IT expertise and he does not get involved in the process of IS/IT adoption and use.
- The CEO does not seem to have a realistic view of the situation related to IS/IT adoption and use. There is a significant gap between the evaluation of the performance of the computer system by the CEO and by all the other interviewees. In fact, the CEO is the only person that sees the computer system has having a positive performance.

- There is conflict of perspectives related to IS/IT, between the manufacturing manager (a member of the board) and the finance manager (also IS/IT manager). While the finance manager preferred to use another software product, developed from a local software house according to the particular requirement of the enterprise, the manufacturing manager had a different opinion. He selected MFG/PRO, based on the potential features of the manufacturing module, although those features have not yet been used.
- Since employees noticed that the data in the computer were not being used by management they stop inputting it. Hence, there is no up-to-date information available on computer about the manufacturing activity of the firm.

The firm did not develop internal competencies to enable IS/IT success. There was no IS/IT knowledge and managers underestimated the potential problems related to IS/IT adoption and use in the organisation. The CEO did not get involved in this process and there were conflicts of opinion between the manufacturing manager and the finance manager (the manager responsible for IS/IT). The quality of IS/IT products and services provided by the external IS/IT suppliers was below the expectations and problems emerged when little support from IS/IT suppliers to implement IS/IT and provide technical assistance was found. On the other hand, the firm was not able to manage internally the process of IS/IT adoption. Nowadays, in order to address these problems, the firm started to hire IS/IT professionals and develop IS/IT processes in-house.



**Table 5.10 - *FIRM 9*: summary**

Industry	Wine industry.
Year of establishment	1834
Turnover and employees	£20 million; 165 employees
<b>1. Internal Context</b>	
• Organisational resources (financial and human)	Cost is not a constraint to IS/IT adoption. The firm is willing to pay if the computer system provides the information the firm needs. There is lack of knowledge about how to use the actual integrated software (MFG/PRO).
• Management perspectives and attitudes towards IS/IT adoption.	The CEO was never much involved in processes of IS/IT adoption and there are conflicts of perspectives between the manufacturing manager and the finance (and IS/IT) manager. Conflicts related with IS/IT adoption are the result of lack of leadership and strategy about IS/IT.
• IS/IT capabilities (IS/IT people and knowledge)	Only recently (in 1994), the firm started to hire IT people. A second IT professional joined the firm in early 1997. After having problems with IS/IT adoption the firm started developing internal capabilities. The CEO has low IS/IT expertise.
• Organisational structure.	Functional structure. Traditional family-owned business. The CEO and his brother are the major owners of the enterprise (6 <sup>th</sup> generation of the founder). The IS/IT department has two IS/IT professional and depends on the finance manager (IT manager).
• Power relationships (conflicts)	There are conflicts of perspectives between the manufacturing manager and the finance (and IS/IT) manager in what concerns IS/IT adoption. Sometimes users show a passive attitude towards IS/IT adoption. Data are not input in the computer system because employees know it will not be used.
<b>2. External Context</b>	
<b>External support</b>	
• IS/IT vendors' support	One of the reasons why the adoption of MFG/PRO failed was due to a poor representation of the software in Portugal.
• Consultant effectiveness	Consultants could not solve IS problems.
<b>IS/IT available (market)</b>	
• Quality of IS/IT available in the market.	For manufacturing there is the need to adapt software to the specifications of the firm. Good administrative software is easier to find.
• Quality of IS/IT external expertise & services available.	Not reported as a relevant issue.
<b>Business Environment</b>	It was not identified any pressure from customers to adopt IS/IT.
<b>3. Content</b>	
• Type of systems	A powerful integrated software system (MFG/PRO), supporting transaction processing and manufacturing tasks. However, the system is not well used.
• IS/IT objectives	Better stock control; financial analysis, etc.
• Evaluation of IS/IT	There were never defined specific objectives to be achieved by IS/IT.
• Time of IS/IT adoption	Slow adoption process.
<b>4. Process</b>	
• Stages followed in IS/IT development	Acquisition. The firm does not develop software in-house except for small programs.
• Models & techniques used.	No use of formal techniques or frameworks.
• IS/IT training	No IS/IT training. The finance manager (and IT manager) argues that users must first start to learn how to use IT by themselves.
• People involved.	Key people: finance and manufacturing managers, IT person, IS/IT vendors.

## **5.11 - Case Study 10**

### **5.11.1 - Introduction: firm's characteristics, history and business strategy**

*FIRM 10* is an SME in the clothing industry, manufacturing products such as sports wear, shirts, trousers, or ladies wear. In 1988, when the enterprise started operating, it was a very small firm. In 1996, there were 160 employees and an annual turnover of £11.2 million. The firm is owned by two entrepreneurs, one of them is the CEO.

It is a strategy of the firm to sell exclusively to well known multinational companies, like Nike, Adidas, Levi Strauss or Calvin Klein. Exports represent 98% of sales. The firm only sells products under customer's brand name and in this market segment there is a strong competition. There is a continuous demand in the market for lower prices, quick response and smaller orders. Many manufacturers are moving their manufacturing plants to Asia or North Africa. However, according to the CEO, the firm has been profitable since the beginning, with performances above the average of the industry. Since it is difficult for *FIRM 10* to compete with low cost producers, the firm tries to be flexible and provide quick response.

IS/IT adoption is important in order to achieve the strategy of the firm, reducing costs and enabling quick response. The firm is relatively sophisticated in terms of IS/IT use. There is an IS/IT department with three people for in-house software development and IS/IT training.

Interviews were conducted with the CEO, the IS/IT manager/expert, the manufacturing manager and an external IS/IT supplier.

### **5.11.2 - Content (type of systems and objectives)**

Since its foundations, *FIRM 10* has been trying to computerise all its business processes. In terms of hardware, there are 40 PCs connected through a Windows NT network. There are two servers for Windows NT, each of them with a double Pentium Pro 200 MHz processor, 8GB hard disk and 128 Mb RAM. There is another server for the manufacturing control system in real-time that is running on a *Novell* network. This system uses several small terminals located in the manufacturing plant to collect data about productivity level. This information can be read at any computer terminal.

As the IS/IT manager explains, the hardware is frequently upgraded,

*The configuration of the PCs changes frequently. We buy computers every month. One year ago, they were all 486Dx2 at 66MHz with 8 MB RAM. At the moment, about half of them, maybe more, are Pentium computers working at 133 MHz or 200 MHz, all with 32MB RAM. (IS/IT manager)*



The firm uses a package from *Infologia* for administrative transactions (accounting and payroll, etc). All the other software was developed in-house, or was bought and adapted according to the business requirements of the enterprise.

The manufacturing control system in real time was acquired three years ago from a small software house. This system is perceived as good by all the interviewees.

The CEO is very demanding and he wants to improve the way production is planned:

*We also have production planning computerised but not as well as we would like it to be. ... I know when I have the raw-materials here, then I pick up that information and I put it in MS Project. Then I plan what will be manufactured each week. These systems are not linked... We do not know any software that is good in all these areas. (CEO)*

FIRM 10 has EDI links with some customers and receives e-mail directly, in-real time, not through a public network server.

*FIRM 10 is a high technology firm. It is a SME with electronic-mail in real-time. If you send an e-mail message to them, they immediately receive the message. They are not linked to Telepac (Portuguese largest national supplier for communication services). (IS/IT vendor)*

*We have internal and external e-mail and Internet. We communicate internally amongst us by using e-mail and there are customers that are linked to us by e-mail... In the future, we will probably be connected directly to Adidas and Nike. This is very recent, we have e-mail since one year ago, EDI, etc. We also have CAD linked to our customers to transfer data about models. (CEO)*

The IS/IT manager explains the relevance of e-mail in the organisation by saying that:

*Internally electronic-mail works. Without e-mail people here would not know what to do. (IS/IT manager)*

The objectives of IS/IT adoption and use in the firm are reducing costs and enabling quick response. However, there is no evaluation of IS/IT benefits or costs.

*Few things can be quantified. Even when we buy a faster computer we know it is faster but we will not say that we will be sending an order 10 times faster. (IS/IT manager)*

The manufacturing control system in real-time is also used to allocate people in the manufacturing plant.

*To have precise information about production costs is very important. We have individual rewards to stimulate productivity. The system allows us to pick up an operation and to know who are the best people to manage that task. (Manufacturing manager)*

### 5.11.3 - A view of success with IS/IT adoption

The firm is classified as a case of moderate success. All the interviewees are satisfied with the way IS/IT has been adopted and used in the organisation.

*Classifying the performance of IS/IT between (1, poor and 5, excellent), 5 never! Between 3 and 4, near 4. (CEO)*

*I would rate the performance of IS/IT as 4. 5 is our target, but it is difficult to get there, there is always something that needs to be done. (IS/IT manager)*

*The performance of IS/IT in terms of user satisfaction is good, but we still want to improve it everyday. It is a 4, thinking about reaching 5. (Manufacturing manager)*

### 5.11.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)

The power is concentrated in the hands of the CEO, one of the owners. The other partner is not an executive. There is a functional organisational structure and relationships are mainly informal. The CEO has some IS/IT knowledge and clearly leads the process of IS/IT adoption.

Financial resources are available and do not constrain IS/IT adoption. The manufacturing manager holds a similar view.

*In our case, it is not cost that inhibits IS/IT development. Cost does not impede us from doing anything. (CEO)*

*FIRM 10 has huge costs in IS/IT. It is difficult to say exactly how much... (CEO)*

*Mr JC (CEO) is very open to IS/IT investments. If this firm works well it is due to the 'coach'. (Manufacturing manager)*

The firm is recent and almost all people are young. According to the manufacturing manager the average age of the seamstresses is 24 years old and the CEO, who is 37, is the oldest manager of the firm. The manufacturing manager is 30 years old, and states that:

*In terms of technologies this is an advantage. Since we are young we are more open to new situations. To us IS/IT is welcome. (Manufacturing manager)*

The IS/IT department has three staff, two people full-time and one part-time. The firm always developed internal IS/IT capabilities, with in-house software development but it also buys software in the market.

*From the beginning we have an IS/IT person here. I hired a seamstress and I hired an IS/IT person. We have had IS/IT since the firm existed. ... (CEO)*



The CEO has some IS/IT knowledge and influenced the way IS/IT was developed in the organisation.

*If you speak with Mr. JC (CEO) about new technology, he knows it. He can not program a computer, but if you talk about Visual Basic, he knows it, if you talk about Windows NT, he knows it, about networks or satellite telephones, ...he knows it. (IS/IT vendor)*

The CEO explains his role leading the process of IS/IT adoption and use in the enterprise.

*Because I did systems analysis in another firm, a firm that operates in the same industry, I knew the problems. I was not able to program the computer but I knew the problems, I knew exactly what I wanted. Then I started working here... I fought against everyone, because everyone was telling me that I would not be able to make software, it would crash, there was not enough memory, etc ...It would have been easier for me to adopt an IBM 36 because the software was already developed for the other firm, but I decided to start developing our own software and I do not regretted... (CEO)*

Nevertheless, the CEO is of the opinion that software should also be bought from external IS/IT suppliers.

*I believe that a firm that wants to develop software should get software developed externally but it must have at least one IS/IT person. The role of this person should be: contact with software houses, provide IS/IT training, and solve users' problems. A small firm that has only a computer, for accounting, it does not justify having an IS/IT person, but for medium-sized enterprises it is necessary. I would not say that it is indispensable but, the ones that have a different opinion, it will find it difficult to be succeeded. (CEO)*

The CEO has a critical role in IS/IT development, fomenting IS/IT adoption since the beginning of the firm, nine years ago. Employees are very young and, according to the interviewees, show a positive attitude towards IS/IT adoption and use. According to the CEO, people are constantly demanding IS/IT services. IS/IT is part of the 'culture' of the firm.

*In FIRM 10, things work in a different way. Employees are the ones that demand IS/IT services. We have very young people, they were used to working with IS/IT and they push IS/IT development. (CEO)*

*Software development is slow... sometimes it is difficult for people in manufacturing to understand why IS/IT is not there, and our people work hard, but there are things that take a long time, which worries me. (CEO)*

According to the manufacturing manager, when the manufacturing control system in real-time was installed, people were initially afraid of being controlled. In his opinion, it is necessary to give people a reward according to their productivity, which is being done.



*We have a manufacturing control system in real time. The system is three years old and was sold by Softgest. In terms of benefits, we achieved some benefits in productivity but it is important that the increase in productivity is followed by rewards ... We have individual rewards to stimulate productivity. The system allows us to pick up an operation and to know who are the best people to manage that task...At the beginning, people were afraid of being controlled. (Manufacturing manager)*

#### **5.11.5 -External Context**

The CEO argues that IS/IT vendors' support is critical for IS/IT success.

*The 'software house' has been a good partner. In order to select IS/IT equipment we look at after-sale support and for quality in the team of the IS/IT supplier... it is basically the team and the support that are important for us to make our decision. (CEO)*

*We believed it was better to have, as partners, an excellent group of people, even with a product slightly inferior to the product of their competitors, than to have the best IS/IT product but with a worse team supporting it... We must work with a team of people who will be with us in the medium/long range. (CEO)*

However, not all IS/IT support has been good. In the past, the firm stopped doing businesses with a software house because their support was not good enough.

*In the past, when I needed IS/IT, I used to get an external IS/IT expert, the one I told you before, but things did not go very well, I would not like to talk about it. (CEO)*

The firm never used external consultants.

The interviewees argue that software packages do not work well in manufacturing and it is difficult to find good software for manufacturing systems. According to the CEO, it is also difficult to find good IS/IT people, particularly for a firm located in the countryside, relatively far from a large city.

*What may be a factor inhibiting IS/IT development is the lack of products in the market. It is difficult to get qualified IS/IT experts. (CEO)*

*We have already seen some products that exist in the market but we were not happy with them... We keep buying software and linking it with ours. It is cheaper than developing it in-house but, unfortunately, we do not find much good software. (CEO)*

For example, the CEO states that in EDI it is not a problem to transfer data about complex products. The problem is the lack of compatibility between systems.

Customers put pressure on the enterprise to adopt IT based communication technologies, such as EDI, and the firm adopts it immediately. Sometimes it is the firm that suggests the use of EDI.



*We are starting working in EDI. This started from us and from the customers, it is a mutual will. We fought to achieve this and so did the customers. (CEO)*

#### **5.11.6 - Process**

The CEO has some IS/IT knowledge and has a dominant role in decision making about IS/IT adoption. IS/IT people and other managers are also involved contributing with their technical opinion for decision making. Software is developed in-house by the computer programmers and it is also bought from external software houses.

There is no use of formal systems analysis and design techniques. In the IS/IT department, software is programmed in Clipper and in Visual Basic. In-house software development or acquisition is carefully evaluated by the CEO and IS/IT people.

*All IS/IT will be re-thought. First we must define the priorities of the firm in terms of software and after defining priorities we must plan the work and define targets for each priority. IS/IT people must be responsible for achieving them. (CEO)*

Employees attend several courses, including IS/IT courses, and the CEO claims that good IS/IT training is very important.

*We have IS/IT courses when the software is developed in-house. When we buy it, we get external experts, because they know better the subject. IS/IT training must increase, we must have more hours for training. (CEO)*

*There are some situations when we have to provide IS/IT education. Sometimes we develop software and we do not pay much attention to IS/IT education. We must be careful with that, the IS/IT team must be careful and find some time to explain to the users how to use the software, to give them in-dept knowledge ... Users must be helped in the initial phase and IS/IT training is very important, and in this area FIRM 10 must improve, in training. (CEO)*

#### **5.11.7 - Discussion of the significant factors**

Although *FIRM 10* is a small firm, since its establishment, in 1988, it started to invest in IS/IT and in the development of IS/IT competencies. The following factors were identified as significant to explain the assessed level of IS/IT adoption and success:

- The CEO (50% owner) encourages IS/IT adoption and IS/IT costs are not seen as inhibiting IS/IT investments. He has some IS/IT knowledge and experience and this enables him to lead the process of IS/IT adoption and use in the enterprise;
- The CEO supports the development of IS/IT knowledge in-house. Even when selecting an IS/IT supplier, he emphasises the importance of having IS/IT knowledge. There are three IS/IT professional, two part-time and one full-time. Software is developed in-house and also acquired from external software houses;

- All managers are relatively young (the CEO, who is 37 years old, is the oldest) and show a positive attitude towards IS/IT adoption and use;
- Managers believe that software packages for manufacturing systems do not work well, hence this software must be specifically designed to fit the manufacturing requirements of the enterprise. Although the firm has three IS/IT professionals the development of most manufacturing software is contracted out, leaving the IS/IT staff free to perform other tasks: users' training, users' support, software maintenance, etc.
- The CEO holds the view that support from IS/IT vendors is critical to the success of IS/IT and the firm is careful in the selection of IS/IT suppliers. He argues that the expertise of the people of the software house is more important than the quality of the software, because if people are good the software will improve in the future;
- Users frequently attend IS/IT courses, and the CEO believes that IS/IT training is very important for the firm;

There is a strong emphasis on the development of IS/IT competencies, in order to build in-house computer applications and manage IS/IT acquisition. The CEO has a determinant role in the firm and he strongly supports the process of IS/IT adoption providing an internal context that facilitates the use of IS/IT in the firm.



**Table 5.11 - FIRM 10: summary**

Industry	Clothing industry (sports wear, shirts, trousers, ladies wear).
Year of establishment	1989
Turnover and employees	£11.2 million; 160 employees
<b>1. Internal Context</b>	
• Organisational resources (financial and human)	Financial resources are available and do not constrain IS/IT adoption. Perceived as good.
• Management perspectives and attitudes towards IS/IT adoption.	The CEO has a critical role in IS/IT development, fomenting IS/IT adoption since the foundation of the firm, nine years ago.
• IS/IT capabilities (IS/IT people and knowledge)	The firm always developed internal IS/IT capabilities, with early in-house software development. There are three IT professionals (two full-time and one part-time). Software is also acquired externally.
• Organisational structure.	Functional organisational structure. Informal relationships. The CEO has some IS/IT knowledge and leads the process of IS/IT adoption.
• Power relationships (conflicts)	All members of the staff are very young and according to the interviewees, show a positive attitude towards IS/IT adoption and use. People are constantly demanding for IS/IT services. IS/IT is part of the culture of the firm.
<b>2. External Context</b>	
<b>External support</b>	
• IS/IT vendors' support	According to the CEO, IS/IT vendors' support is critical for IS/IT success.
• Consultant effectiveness	No use of consultants.
<b>IS/IT available (market)</b>	
• Quality of IS/IT available in the market.	Packages do not work in manufacturing. Difficult to find good software for manufacturing systems.
• Quality of IS/IT external expertise & services available.	According to the CEO it is difficult to find good IS/IT people.
<b>Business Environment</b>	Customers exert pressure to adopt IT based communication technologies, like EDI, and the firm responds well, installing those systems.
<b>3. Content</b>	
• Type of systems	Manufacturing planning, CAD/CAM and administrative software.
• IS/IT objectives	Reducing costs.
• Evaluation of IS/IT	No evaluation of IS/IT benefits or IS/IT costs.
• Time of IS/IT adoption	IS/IT adopters since the establishment of the firm, in 1989.
<b>4. Process</b>	
• Stages followed in IS/IT development	The CEO and IS/IT people carefully evaluate in-house development and software acquisition.
• Models & techniques used.	No formal analysis and design techniques. Visual Basic used.
• IS/IT training	People attend several courses, including IS/IT courses.
• People involved.	CEO, IT people, IS/IT vendors.

## **5.12 - Case Study 11**

### **5.12.1 - Introduction: business characteristics, history and strategy**

*FIRM 11* is a footwear enterprise that was created in 1964. The firm manufactures medium/low quality men's shoes. About 85% of production is exported (to the British and Scandinavian markets) and competition is based on price. There is an increased competition in the market and the firm is trying to get cheaper raw-materials from Asia and South America to become more competitive. There is also a strong pressure from the market in terms of faster response time. Profits have been recently decreasing.

In 1997, turnover was about £4m and the firm had 123 employees. There are two owners, holding a share of 50% each. One of these people is the CEO. The owners are also shareholders of another small footwear manufacturing firm (although they have other partners) specialising in children's footwear. The son of the CEO owns an exporting enterprise that exports most of the production of the firm. He is also shareholder of two IS/IT firms (one selling software and the other hardware) that provide IS/IT products and services to *FIRM 11*. The CEO, the general manager, and an external IS/IT supplier were interviewed.

### **5.12.2 - Content (type of systems and objectives)**

Integrated manufacturing software was developed and installed in the firm, in 1990. However, this software was being improved until 1995. The software was specifically developed for the enterprise by a small local software house that was just starting, although now the software is sold as a package to other footwear manufacturing enterprises (including *FIRM 8*). One of the owners of the software house is the son of the CEO, hence there is a close co-operation between both firms. The general manager states that: "*we started to develop MSW (manufacturing software) from scratch, from making labels for shoe boxes to recording productivity levels, which is the critical part of this*". For the general manager, the most important feature of the software is access to a database with the costs of each component and manufacturing processes that allows the definition of the price of the shoe.

*Sewing is the biggest problem. It is in this area that we must start creating a database so that we can see each cut and configuration, to record the time spent in sewing. If we can do a sample for the customer, we record the time spent, but many times the customer arrives with the sample and asks us how much does it cost. We do not have the time recorded but we must give him a price.* (General manager)

Although the firm outsources accounting, it uses a Portuguese software package (common to many other firms analysed in the study) for administrative purposes. The firm purchased a CAD/CAM system, developed by *Clarks* (the British footwear retailer). There is a 2D module for components and a 3D module for design. The firm is



considering to implement manufacturing control in real-time and is waiting for financial support from the government. All of the existing manufacturing systems were partially supported by government funding.

According to the interviewees the aim of IS/IT in the firm is to provide a better organisation of the enterprise and there was no formal evaluation of IS/IT benefits.

### **5.12.3 - A view of success with IS/IT adoption**

The interviewees expressed positive levels of satisfaction with IS/IT adoption and use. Nevertheless the general manager states that nowadays the hardware is obsolete and the firm has been waiting to get government funding to buy new hardware. However, if this funding does not come the hardware will be bought anyway.

*In my opinion the performance of IS/IT in this firm can be classified as 4 (on a scale from 1 to 5). I am very happy with it. (CEO)*

*I would rate IS/IT in the firm as 4 or 5 (1, poor and 5, excellent). The hardware I would rate it as 2, in terms of software 4. I am happy with what I have. I am happy with the system MSW. I attended some software presentations in other firms and I have not seen better. (General manager)*

Since the CEO is a close friend of the CEO of FIRM 8 he also confirms some of the problems found in case study 8. The head of the software house also states that:

*FIRM 11 is our example of success because they are using the whole software system. They are using everything and, according to the general manager, the enterprise can not work without the software. (IS/IT vendor)*

### **5.12.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)**

There is a simple organisational structure, common to a firm of the size of FIRM 11. The CEO is more a supervisor of the business activity (he is more than 70 years old and owns 50% of the firm) and exerts an important role in strategic decision making. Operational decisions are concentrated on the general manager (37 years old), that is the son-in-law of the other owner (who is not an executive).

The firm has invested around £40,000 in IS/IT. Although there were government funds involved, the CEO stated that he would invest any way, except in the CAD/CAM, which was too expensive compared with the benefits provided.

There is a strong link with a software house and a hardware supplier. This link is based on family links and enables the necessary IS/IT expertise the firm needs. There are no in-house experts, although the CEO views the software and hardware suppliers as an

extension of his own enterprise. One problem noticed was the fact that CAD/CAM experts after becoming experts tend to leave the firm because they get better offers from other firms.

The CEO recognises the importance of having new technologies and more specifically IS/IT. He is open to invest in IT. The son of the CEO, that is also a business partner of *FIRM 11*, holds a software house and a hardware firm, and that was important for the development of IS/IT in *FIRM 11*.

Some minor problems with users' expertise to use computers were reported, mainly using CAD/CAM system. In the warehouse, there is an employee who has been working for the firm for more than 20 years and is not able to work with the computer. A younger person was sent there to help him and later the person previously in charge of the warehouse was reallocated to other tasks.

It was reported, by the general manager, that people were not afraid of losing their job because of the implementation of computers. On the other hand, computers were noticed as a way of asserting power in the organisation:

*Computers do not replace tasks. On the contrary, I noticed that some people even without needing a computer wanted one on their desk because they are the ones in charge of the section, even if they are not the ones that need to use the system. (General manager)*

#### **5.12.5 - External Context**

Naturally the firm gets good vendor's support. Free IS/IT consultancy is also provided by the software house. The firm is special to the software house, because it is also a 'laboratory' to develop and improve the software. The IS/IT expert from the software house states:

*It is also important to know the industry and we get support from a footwear enterprise, *FIRM 11*, and an exporting firm, *Clique*. These were the first firms where we developed our system. Our initial know-how comes from these projects. After that, the contact with customers also gave us experience. (IS/IT vendor)*

The general manager has some knowledge of the software available in the market and states that the existing software for manufacturing in other firms is not better than the one the firm uses. Since there is a strong link with a software house the firm does not evaluate alternatives. *FIRM 11* did not get any suggestion from customers to adopt EDI. At the same time, the firm is too small to influence any of its large customers.



### 5.12.6 - Process

The manager, the son of the CEO, and the head of the software house had a critical role in the development of IS/IT. There is a close support from the software house and the IS/IT experts from the software house are perceived by the CEO as employees of the firm. Hence, there is no in-house development and the software house supplier develops manufacturing applications.

Systems analysis & design is done by the software house, using structured analysis techniques. The software code was developed in Informix 4GL. The software house also provides IS/IT training.

### 5.12.7 - Discussion of the significant factors

In this case, managers expressed high levels of satisfaction with IS/IT adoption and use. The factors identified as important to explain the levels of adoption and success are:

- There is a co-operation scheme amongst five firms that enables their mutual success. These firms are: *FIRM 11*, an exporting company that heavily uses IS/IT (that belongs to the son of the CEO), another manufacturing footwear enterprise (with common owners of *FIRM 11*), the hardware supplier, and a software house (in both these two firms the son of the CEO is a major shareholder);
- The close relationship with the software house and the hardware suppliers has an important impact on the way IS/IT was developed in the firm. The firm does not have in-house IS/IT expertise, and does not need it. The son of the CEO is a major shareholder of the two IS/IT firms that supply computer products and services to *FIRM 11*. Hence, the CEO sees these firms as extensions of his own firm;
- An integrated manufacturing software that was specially designed and developed, by the software house, according to the business requirements of the firm;
- The general manager is the "IS/IT champion". He is a person that has the CEO's trust and he was deeply involved in the systems analysis phase, co-operating with the expert of the software house;
- The software house supplier also develops its own knowledge building software for *FIRM 11* that it later sells to other manufacturing enterprises. As one of the IS/IT experts of the software house says, "*FIRM 11 is our lab*".

*FIRM 11* has very strong links to its external context in regard to IS/IT adoption and use. Operating in a network environment allows the firm to get access to IS/IT services and products without developing its internal IS/IT competencies. The entrepreneurs are

not much involved in the process of IS/IT adoption, instead their heirs assume a dominant role in it. Because of the network environment, in this firm it is difficult to identify the boundaries between the internal context and the external context. Nevertheless, the firm has privileged access to IS/IT knowledge and the process of IS/IT adoption and use is well managed.



**Table 5.12 - *FIRM 11*: summary**

· Industry	Footwear industry.
Year of establishment	1964
Turnover and employees	£4 million; 123 employees
<b>1. Internal Context</b>	
· Organisational resources (financial and human)	Large investments in IS/IT. Although there were government funds involved, the CEO stated that we would invest in IS/IT any way, except in CAD/CAM, which was too expensive compared to the benefits provided. There were reported some problems because users lack IS/IT expertise.
· Management perspectives and attitudes towards IS/IT adoption.	CEO recognises the importance of having new technologies and, more specifically, IS/IT. He is open to invest in IS/IT. The son of the CEO, that is also a business partner of <i>FIRM 11</i> , holds a software house and an hardware firm, and that was important for the development of IS/IT in <i>FIRM 11</i> .
· IS/IT capabilities (IS/IT people and knowledge)	There is a strong link to a software house and a hardware supplier. This link is based on a family relationship and enables the necessary IS/IT expertise the firm needs.
· Organisational structure.	There is a simple structure, with most intermediate management decisions concentrated on one of the top managers. The CEO (72 years old) is more a supervisor, although important in critical decision making. The firm uses external accounting services.
· Power relationships (conflicts)	No significant conflicts reported.
<b>2. External Context</b>	
External support	
· IS/IT vendors' support	There is good vendor's support.
· Consultant effectiveness	IS/IT consultancy is provided by the software house.
IS/IT available (market)	
· Quality of IS/IT available in the market.	Other software systems are perceived as inferior to the one the firm has.
· Quality of IS/IT external expertise & services available.	Since there is a strong link to a software house, the firm does not evaluate alternative options to develop or acquire software.
Business Environment	Customers never exerted pressure to adopt EDI.
<b>3. Content</b>	
· Type of systems	A manufacturing systems, accounting package and a CAD/CAM system. The firm is looking for IS/IT integration.
· IS/IT objectives	Better organisation of the enterprise.
· Evaluation of IS/IT	No formal evaluation of IS/IT costs and benefits.
· Time of IS/IT adoption	The firm installed the actual manufacturing software in 1990, although it has been improved since then.
<b>4. Process</b>	
· Stages followed in IS/IT development	The software house followed the major phases in software development, including IS/IT analysis and design.
· Models & techniques used.	The analysis was done by using structured analysis techniques and the code was developed in Informix 4GL.
· IS/IT training	The software house supplier has provided some IS/IT training.
· People involved.	The general manager, the son of the CEO (a business partner of <i>FIRM 11</i> ) and the IS/IT consultant/vendor.

## **5.13 - Case Study 12**

### **5.13.1 - Introduction: business characteristics, history and strategy**

*FIRM 12* is a 100% family-owned clothing manufacturing enterprise established in 1961. In 1997, turnover was around £10m.

The enterprise exports 100% of its production. Major customers include Marks & Spencer, Levi Strauss, Diesel, and Mark'O Polo. It has a production line dedicated to manufacture shirt samples for customers. The firm competes on price but also tries to differentiate its product by adding value to the service. Delivery time is also very important for the business.

*The product we manufacture can be made outside the firm. The firm is not only a shirt manufacturer, it tries to provide a service to the customer. It tries to be different.*  
(Finance manager)

When the current board of directors arrived, in 1994/95, they intentionally dropped the largest customer the firm had - Zara. Zara represented more than 30% of sales. The administration ended the business relationship with Zara and sales dropped by £3 million. The strategy was to reduce the organisational structure in order to be able to make better deals with customers and not being forced to accept many orders. As a consequence, the number of employees has been reduced significantly in the last 3 years. Now, the firm has 350 people.

Interviews were conducted with the finance manager, the IS/IT manager/consultant and two IS/IT experts. The CEO, although contacted and authorising the research, did not want to be interviewed, arguing that she is not comfortable with the subject. She pointed out the finance manager as the right person, at a management level, to talk about IS/IT adoption and use in the firm.

### **5.13.2 - Content (type of systems and objectives)**

Initially, the firm had an IBM system 38. In 1990, an IBM AS/400 system, that cost about £96,000, was bought to replace the previous one. Later, the firm also acquired an IBM RISC 6000 for manufacturing purposes. However, in 1995, data processing was very slow and hard disk storage was not enough. Hence, an AS/400 with PowerPC was bought for £28,000.

There is an integrated software system for administrative and manufacturing purposes developed in-house, in RPG. The system has a poor graphical interface but according to the IS/IT manager/consultant it is enough for the needs of the firm. Sometime ago, one of the major customers suggested to the use of EDI. However, the firm is not happy with that customer and may stop supplying it.



The firm is thinking about investing in a CAM system, but first its profitability must be analysed. The finance manager argues that CAM is more used in the knitwear industry and *FIRM 12* only manufactures small series. Nevertheless, CAM could also reduce labour costs. The analysis of the investment is important in order to decide about buying a CAM system. According to the finance manager, this does not bring a significant social problem because seamstresses easily find other jobs, because salaries are not high and many employees try to find a better job.

#### **5.13.3 - A view of success with IS/IT adoption and use**

All the interviewees evaluate IS/IT in the firm as a 4 (in a scale from 1 to 5).

*If I have to evaluate our computer systems in a scale from 1 to 5, I would say 4. In a scale from 1 to 10, I would say 7... The computer system we have is satisfactory. It provides information, it is not because of it that we do not do business. We should think about a better software to produce something more. (Finance manager)*

*I would classify the performance of IS/IT in the enterprise as a 4. We do not reach 5 because there is a national culture of being satisfied just before reaching a good situation. (IS/IT manager/consultant)*

*If I had to classify the computer system between 1 and 5, I would classify it as a 4. I know other firms and what they have is awful. I can not say this is excellent, not even "beautiful", since there is no graphical interface, but it is functional ... it is very difficult to find enterprises in the clothing industry with all what we have here computerised. There is a lot of work here in this computer system, developed along many years. (IS/IT expert)*

#### **5.13.4 - Internal Context (organisational structure, resources, IS/IT knowledge and attitudes towards IS/IT)**

There is a functional organisational structure. The enterprise is 100% family owned. There are three owners. The major owner (70%) is a member of the board of directors but not an executive. The CEO is one of her daughters and owns each one 15% of the firm. There is also another director, an engineer that manages manufacturing. The board of directors has been changing several times in the last years, since previous managers did not perform satisfactorily. The finance manager states that:

*This is a family type of business that looks for a professional type of management. This administration tries to control costs and decision making. The CEO and Mr FB, an engineer with previous top management experience in several enterprises went here in 1994, because he was a friend of the family. (Finance manager)*

Although the finance manager declares that there is no rigorous evaluation of IS/IT investments, he states that IS/IT costs nowadays do not inhibit the firm from investing



in IS/IT. Although management knows the importance of IS/IT, in the past, there was a period when the firm could not invest in IS/IT because of lack of financial resources.

*IS/IT costs do not inhibit IS/IT investments. Although we try to analyse profitability of IS/IT investments, it is not possible to evaluate it properly. It is not possible to quantify the cost/benefit of IS/IT investments. (Finance manager)*

*The cost of equipment is not an inhibitor of IS/IT development. When something is needed there is no problem and we buy it. When it was necessary to increase the performance of the computer system there was no significant obstacles to up-grade it. (IS/IT expert)*

The firm has an IS/IT department with three IS/IT people (one full-time and two part time). The head of the IT department is an external IS/IT consultant, that was a previous manager in the firm. Now he has his own business, selling computer systems and software. He goes to the enterprise once a week. He is the person in charge of IS/IT. He defines the tasks that IT people must do and puts pressure on the board for new software or hardware acquisition. According to the IS/IT people, the board does not have IS/IT expertise and they are receptive to the recommendation of the IS/IT manager/consultant.

The IS/IT manager/consultant states that when he started working in IS/IT he did not know much about IT, and even today he is not an IT expert. His role is to link IS/IT with the business needs.

*The success of this IS/IT 'implementation' was due to this link between IT and the functional needs. We developed here an attitude of 'service provider', a relationship between 'customers' and 'information suppliers'. (IS/IT manager/consultant)*

Software is developed in-house and that is perceived as important, to have the computer systems the firm wants:

*We develop software in-house. There was a phase when we used to have accounting from a software house... The only application here that is external is accounting although there are many recent changes. All the other systems were developed in-house. (IS/IT expert)*

*It is an important success factor for the success of IS/IT in this firm the fact that we have here all the people necessary to develop any software... most manufacturing SMEs do not have IS/IT professionals and then have problems implementing IS/IT in their enterprises. (Finance manager)*

Since IS/IT is in the firm for long time, people are very demanding for IS/IT services. The interviewees see this as a critical factor for IS/IT success.

*An IS/IT success factor in this firm is having professionals that want always more. That critical behaviour makes us reaching better solutions. (Finance manager)*



*A critical success factor for IS/IT success in this enterprise is the fact that the users and directors are very demanding. (IS/IT expert)*

The CEO supports IS/IT investments and she is also a user.

*When it is necessary any new computer systems the board asks for if it is really necessary and if we say yes, they buy it. They provide the means. (IS/IT expert)*

The IS/IT manager/consultant also has a very dynamic attitude, exerts pressure on the board, on the users and on IS/IT professionals to make IS/IT work in the firm.

*If there is the need to do something, Mr. JG (IS/IT manager/consultant) 'gives his face to it' and if something is important, it must be done, no matter what. That attitude is important to make things work. There is no 'put it off till another day'. This is a relevant factor. (IS/IT expert)*

#### **5.13.5 - External Context**

The IS/IT manager/consultant argues that the firm should buy software, but there is no good software available in the market, only projects to develop software or simple programs with fancy interfaces.

*We have always been interested in buying software, instead of developing our software in-house, but there is none available. It simply does not exist. The market does not offer software for this industry or when it offers prices very high and it will make us dependent from IS/IT suppliers. Those conditions are impossible for this type of firm. (IS/IT manager/consultant)*

#### **5.13.6 - Process**

The firm started adopting IS/IT since the 70s. The people involved in IS/IT adoption and use are the IS/IT manager/consultant, the IS/IT experts and the board of directors for decision making. There is no formal evaluation of IS/IT benefits. Most software was developed in-house in RPG, using informal techniques for systems analysis. According to the IS/IT people, adapting the software to a relational database management system would be hard.

There is also no formal IS/IT training, people learn how to use the software by using it. However, one can say that the users are very demanding and that contributes to a continuous improvement of the system.

*Users have an active role and suggest changes. If we can easily do it, we do. If it is something more complex, we ask permission to Mr JG (IS/IT manager/consultant) or the board of directors. (IS/IT expert)*

### **5.13.7 - Discussion of the significant factors**

*FIRM 12* shows positive levels of IS/IT satisfaction and the following factors related to IS/IT adoption and success:

- There is IS/IT expertise in the firm. It has an IS/IT department with three IS/IT people, managed by an IS/IT consultant who was a former manager of the firm;
- Top managers are not involved in the process of IS/IT development, they delegate that task to the IS/IT manager/consultant;
- The IS/IT manager/consultant owns an IS/IT enterprise and has a critical role in the process of IS/IT adoption and use in *FIRM 12*. He defines himself as a “manager” with some IS/IT knowledge. He states that his main usefulness comes from being able to understand both the IT people of the firm and the users, making communication between them easy in order to implement computer systems that are aligned with the requirements of the business.
- Since IS/IT has been in the firm for a long time, users (including the members of the board) are very demanding for IS/IT services and this also forces IS/IT staff to improve themselves;
- The integrated software system, although old, was developed in-house by the IS/IT department, in conformity with the requirements of the business. According to the IS/IT manager/consultant, there is no good software available in the market for manufacturing. Therefore, the only solution is to develop software in-house and that was what the firm has been doing;

The internal context of the firm enables the development of IS/IT products and services in-house. There are IS/IT competencies in-house and a top management supporting IS/IT adoption and use. According to the interviewees, external IS/IT suppliers are not able to provide adequate IS/IT products and services, but that is not a major concern for the enterprise. *FIRM 12* is developing in-house computer applications in line with the requirements of the business. However, the existing integrated software system was implemented a long time ago and is not very sophisticated. Replacing the computer system requires deep changes in the IS/IT infrastructure and the IS/IT manager/consultant is avoiding making those changes. He is of the opinion that those changes would consume too much time and financial resources.



**Table 5.13 - FIRM 12: summary**

Industry	Clothing industry.
Year of establishment	1961
Turnover and employees	£10 million; 350 employees
<b>1. Internal Context</b>	
• Organisational resources (financial and human)	Although management knows the importance of IS/IT investments there was a period when the firm could not invest in IS/IT because of lack of financial resources. However, IS/IT costs are not perceived as a significant constraint for IS/IT development. At the beginning, some problems were reported by IT people related to IS/IT adoption, although these were not a major concern..
• Management perspectives and attitudes towards IS/IT adoption.	Although the members of the board do not have much IS/IT expertise, they are receptive to the recommendation of the IS/IT consultant/manager.
• IS/IT capabilities (IS/IT people and knowledge)	Available. There is an IS/IT consultant, who was a former manager of the firm and still acts as IS/IT manager. The firm has two part-time IT professionals and one in full-time.
• Organisational structure.	There is a functional structure. The enterprise is 100% family owned. However, the administration board has been changing several times in the last years. Recently, there was a deep restructuring process and a major customer was dropped.
• Power relationships (conflicts)	The fact that users and the administration board are very demanding about IT services is perceived as a critical factor for IS/IT success. In the past, some negative attitudes towards IS/IT use were found. Since IT is in the firm for a long time people are very demanding for IS/IT services.
<b>2. External Context</b>	
<b>External support</b>	
• IS/IT vendors' support	No use of external vendors, in-house development.
• Consultant effectiveness	Perceived as good. There is a strong link between the IT consultant and the firm (he was a former manager).
<b>IS/IT available (market)</b>	
• Quality of IS/IT available in the market.	According to the IS/IT manager/consultant there is no good software available for manufacturing, only projects or easy programs with fancy interfaces.
• Quality of IS/IT external expertise & services available.	Since 1973, the firm has IS/IT experts in-house.
<b>Business Environment</b>	In the past, there was a suggestion by Levi Strauss to use EDI but interorganisational information systems have not been implemented yet.
<b>3. Content</b>	
• Type of systems	There is an integrated software for manufacturing and administrative purposes developed in-house using RPG. CAD is also used in the firm.
• IS/IT objectives	More efficiency.
• Evaluation of IS/IT	No formal evaluation of IS/IT costs and benefits.
• Time of IS/IT adoption	Early IS/IT adopters, since early 70s.
<b>4. Process</b>	
• Stages followed in IS/IT development	In-house software development, using informal systems analysis.
• Models & techniques used.	No formal analysis techniques used. Only RPG code.
• IS/IT training	There is no formal IS/IT training, people learn how to use the software by using it.
• People involved.	IT consultant/manager, IT people, and the administration board for decision making.

## **5.14 – Conclusion**

In this chapter, twelve case studies were presented and discussed. These cases cover a range of levels of IS/IT adoption and success across different industries. The analysis of the set of cases is conducted in the next chapter, by analysing the importance of the each individual factor identified from the interviews as related to IS/IT success, and by looking for patterns of factors amongst the cases that have similar levels of IS/IT adoption and success. Although the firms studied operate in different industries and have adopted different types of computer systems, they may have similar characteristics and behaviour that explain the assessed levels of IS/IT success.



## Chapter 6

### **Cross Case Data Analysis**

#### 6.1 - Introduction

This chapter discusses, analyses and interprets the data collected in the case studies. This analysis is carried out by factor and by cluster of firms. First, a view about IS/IT success will be discussed and defined in order to provide a basis to cluster the firms according to their relative assessed level of IS/IT success. Second, each individual factor identified as related to IS/IT success is discussed and its importance evaluated. These factors will be classified according to their relative importance in determining IS/IT success. Third, the data about the firms in the same cluster is analysed looking for pattern and mechanisms that may explain the level of success. At the end of the chapter, a model is presented that shows the factors affecting IS/IT adoption and success and their relationships.

#### 6.2 - A view about IS/IT success

The concept of IS/IT success used in this study is based on the concept of *user information satisfaction*, as described in chapter 2. However, in order to evaluate IS/IT success, the concept of *user information satisfaction* is used in a slightly different way to which it is commonly suggested in the literature. It was found in the fieldwork that interviewees in the same organisation may have completely different levels of satisfaction with IS/IT. The level of IS/IT satisfaction of the interviewees is influenced by several factors, such as their professional role in the organisation, level of IS/IT knowledge, 'computer systems' usage, or prior expectations about the benefits they may get from IS/IT. For example, in *FIRM 8*, the CEO revealed high levels of satisfaction with IS/IT and he seemed to be completely unaware of the problems the firm has with IS/IT implementation; problems that were reported by the other interviewees. This can be explained because the CEO is an elderly person and does not have any IS/IT knowledge. He is not a computer user and does not seem to realise the full set of benefits the firm may get from IS/IT adoption and use. Moreover, there is a perceived "large power distance"<sup>1</sup> between the CEO and the finance manager (the *IS/IT project champion*), which makes communication between them difficult. The finance manager seems to avoid making suggestions to the CEO about how IS/IT must be implemented

---

<sup>1</sup> The concept of "power distance" is defined in Hofstede (1980 and 1991) and basically highlights the concept of perceived hierarchical distance (or proximity) between managers from different hierarchical levels.



in the firm. The IS/IT expert from the software house does not discuss IS/IT matters with the CEO either. His interlocutor in the enterprise is the finance manager.

In some other case studies, differences of opinion amongst interviewees were also found. Although interviewees were asked to classify their level of satisfaction with IS/IT performance on a scale of 1 to 5, this data cannot be analysed from a quantitative perspective. It must be interpreted according to its context. The values given by interviewees are not seen as completely objective and unquestionable. Nevertheless, they help to clarify and understand the point of view of the interviewee. For example, in *FIRM 11*, an in-depth analysis of the statements given by the general manager, to evaluate his level of satisfaction with IS/IT, uncovers some 'inconsistencies'. The general manager gave the following statement about his level of satisfaction with the performance of IS/IT: *"I would rate IS/IT in the firm as 4 or 5. The hardware I would rate as 2, in terms of software, 4. I am happy with what I have..."*.

It was also noticed that some managers were not comfortable defining their level of satisfaction with IS/IT. In some cases, in spite of the interviewees clearly identifying and revealing existing problems with IS/IT, they seemed to avoid a negative evaluation of the process of IS/IT adoption and use in the organisation. For example, in *FIRM 6*, although the administrative manager evaluated her level of satisfaction with the computer system as 3, she also mentions the software specifically developed for the enterprise as a 'failure', and expresses disappointment about its performance. In *FIRM 9* the statements provided by an interviewee did not fit with the written answers given on the questionnaire later completed. This manager, although explaining in the interview the process of IS/IT adoption and use and clearly expressing his low level of satisfaction with IS/IT development, later, in the questionnaire, he contradicts the prior negative evaluation of IS/IT.

In some of the cases, the CEO tried to present a slightly better situation of IS/IT adoption and use in the organisation than it really was. It is interesting to note that although several interviewees expressed low levels of satisfaction with IS/IT, all CEOs declared they were at least satisfied with IS/IT adoption and use in the enterprise. Since data were collected from several sources, it was possible to identify through data triangulation where and why some data did not match.

After an initial qualitative analysis of the data provided by the semi-structured interviews with managers and IS/IT experts, four levels of success with IS/IT adoption and use were defined in the SMEs studied: **success, satisfactory, less than satisfactory and unsuccessful**. The classification of the cases into these groups is also subjective, based on the perceived level of IS/IT satisfaction of the interviewees, and influenced by the researcher's interpretation of the data. It is argued in this study that any evaluation and classification involves subjectivity because it depends on people's perspective and view of the world. Users have different roles, knowledge, backgrounds, and interests,



which cause them to have only a partial view of the situation. Therefore, it seems much more relevant from an academic perspective to understand each case by analysing the different views expressed by the interviewees than trying to force consensus where sometimes it may not exist. Any model, framework of classification is a tool that enables a simpler way to analyse and understand a complex reality. From this perspective, there are no perfect models, frameworks or classifications, but better and worse tools according to their usefulness to understand a particular phenomenon. These contribute to sustain an argument and explain a particular view. Their validity should be seen more in terms of usefulness to obtain a reasonable explanation of the phenomena under analysis rather than to exhibit the ultimate truth. This view is consistent with a Realist perspective of social enquiry as discussed in chapter 4.

The criteria used to interpret the data gathered in the fieldwork and cluster the firms according to their relative level of success with IS/IT adoption and use is essentially based on three issues: the level of user information satisfaction expressed by the interviewees; problems and potential solutions identified by the interviewees related to IS/IT adoption and use; and the contribution of IS/IT to the business perceived by the interviewees. Similar criteria to evaluate IS/IT success can be found in the IS/IT literature (Earl, 1990, 1993; McGolpin, 1996). For example, Earl (1993) reports that in the field of information systems most measures of IS/IT success have relied upon satisfaction scores, absence of problems, and audit checklists. This researcher, analysing firm's success with strategic information systems planning, evaluated five levels of success based on respondents' satisfaction scores (from 1 to 5): *highly successful*, *successful*, *"worthwhile doing"*, *dissatisfaction* and *unsuccessful* (Earl, 1990, 1993).

The following paragraphs describe the four levels of success with IS/IT adoption and use defined in this research:

**Success** - Managers interviewed stated that they were highly satisfied (4 or 5) with the adoption and use of IS/IT in the firm, with the existing computer systems and their contribution to business performance. No actual significant problems were reported or better feasible solutions for IS/IT adoption and use identified by the interviewees. Interviewees stated that significant business benefits were achieved by the use of IS/IT.

**Satisfactory** - Interviewees were positively satisfied (3 or 4) with IS/IT adoption and use in the firm but some problems still exist or better ways of IS/IT adoption and use were identified. Interviewees revealed that real business benefits were achieved by the use of IS/IT.

**Less than satisfactory** - Interviewees expressed low levels of satisfaction with IS/IT adoption and use in the firm (2 or 3); significant problems with IS/IT were reported, but interviewees also foresee feasible ways to correct those problems in a reasonable time scale. IS/IT is perceived as having a low contribution to business performance.



**Unsuccessful** - Many of the interviewees were not satisfied with IS/IT adoption and use in the enterprise (1 and 2) or deep problems with IS/IT adoption and use were reported, without identifying any feasible solutions to these problems in the short/medium term. IS/IT is perceived as having a poor contribution to business performance.

There were also defined four different levels of IS/IT adoption, based on the literature and data collected in the case studies. In the first level there are: a) enterprises using only administrative systems; b) enterprises that also had core manufacturing processes computerised; c) enterprises using integrated software systems for administrative and manufacturing purposes; d) enterprises that had achieved internal and external integration through administrative and manufacturing computer systems.

Based on these relative levels of IS/IT success and the extent of IS/IT adoption the firms cluster into four groups. Firms in *cluster A* were classified as successful. Firms in *clusters B* and *C* were classified as satisfactory, but while firms in *cluster B* have their core processes computerised using integrated software, firms in *cluster C* use IS/IT to support their core manufacturing processes but do not have integrated software yet. Finally, firms in *cluster D* are the ones that show low levels of satisfaction with IS/IT. The firms that were classified as “less than satisfactory” or “unsuccessful” with IS/IT adoption and use, were clustered together. This is because it was found that they have a similar *internal context*, in spite of the different levels of IS/IT sophistication, which is likely to explain the low level of satisfaction with IS/IT adoption and use.

The firms were selected for research to cover a range of cases, combining several levels of IS/IT adoption and different assessed levels of IS/IT success, as is shown in figure 6.1. However, some particular situations were not covered because extreme cases are unlikely to be found. For example, it would be difficult to find a manufacturing enterprise using only administrative systems, being described by interviewees as a case of success with IS/IT adoption and use. Top managers would probably feel the need to computerise the manufacturing processes, moving the firm forward in the scale, creating higher expectations and finding new problems. On the other hand, external integration is more likely to occur when the core processes are already integrated and working satisfactory. Hence, firms that reach a stage of external integration were likely to have positive levels of satisfaction in the previous stages of IS/IT adoption.

Figure 6.1 presents a map of the SMEs studied according to the assessed relative levels of IS/IT success and levels of IS/IT adoption. Since IS/IT adoption is a dynamic process, the arrows indicate the tendency of the firm, what the firm intends to do, where it is likely to be in a near future. For example, *FIRM 5* is now implementing an integrated software system. Although *FIRM 9* has an integrated software system available, the implementation of the software did not go well and the system is little used for manufacturing purposes, hence the firm is more in the stage of using only basic



administrative software. *FIRM 6* has low levels of IS/IT adoption, using basically administrative systems, trying now to computerise its manufacturing processes (arrow). Nevertheless, this enterprise is having some problems moving forward to an extended level of IS/IT adoption and use (hatched arrow). *FIRM 4*, is represented in two different positions because it has some external integration, achieved through the use of interorganisational systems but there is no integrated computer-based information system for the core processes of the organisation.

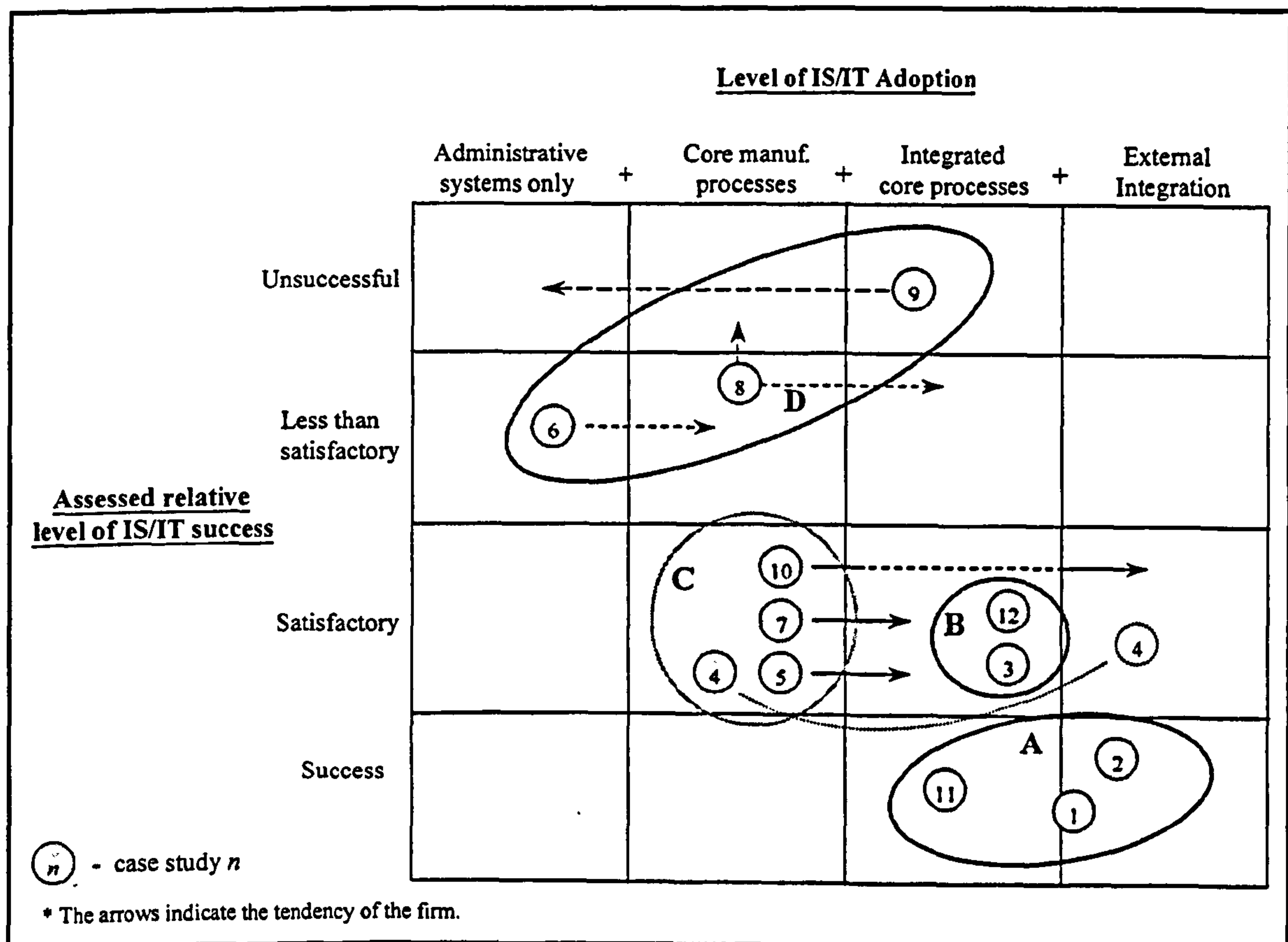


Figure 6.1 – The clusters for analysis  
Source: Compiled by the author

### 6.3 – The structure of the analysis

The framework for analysis is based on the work of Pettigrew *et al.* (1989) and Pettigrew and Whipp (1991). The dimensions *content*, *internal context*, *external context* and *process* are not independent. On the contrary, some factors that are classified under different dimensions are related amongst themselves. Explaining these links is important to understand how the framework can be used for the purposes of this research. These dimensions can be seen as open systems that continuously exchange information amongst them. The key to understanding the model is its interconnectedness and no

factor by itself is able to explain IS/IT success. Both the internal and external context shape the way the process of IS/IT adoption is conducted and have an impact on the type of computer systems implemented (*content*).

The internal and external contexts are also interrelated. Some combinations of factors associated with the internal context are likely to enable a better link with the external context leading to higher levels of relative IS/IT success. The data analysis is conducted first by cluster, by analysing the *content*, *process* and *context* of IS/IT adoption for each cluster. Second, a cluster sensitivity analysis is carried out, which evaluates other different clustering options and their impact on the findings. Third, the relative importance of each factor is assessed, based on the data collected in all the case studies. Fourth, those factors are classified into four different groups, according to their relevance to explain IS/IT success and adoption.

## **6.4 – Data analysis by cluster**

### **6.4.1 – Cluster A (*FIRMS 1, 2 and 11* – see table 6.1 for details)**

#### **6.4.1.1 - Internal context**

These firms have a similar internal context. In all of them, the owners/CEOs support IS/IT adoption and use and there is IS/IT knowledge available. However, this knowledge is expressed in different ways. None of these firms have much in-house software development. In *FIRM 1*, CAD/CAM and interorganisational systems are critical for the firm and these are acquired externally. IS/IT knowledge comes from selecting the software and adapting it properly according to the needs of the firm. The existing IS/IT competencies are orientated to adapt, before competitors, modern information technology to the requirements of the business. IS/IT is perceived as extremely important for the firm, and there is a continuous search for new computer applications and better ways of IS/IT use. There are IS/IT people to provide the means to acquire software and hardware, and to develop some specific applications that are not available in the market.

In both *FIRM 2* and *FIRM 11*, software is developed by software houses. However, there is a strong link between these manufacturing SMEs and the software houses. In *FIRM 2*, the software house was the natural evolution of the IS/IT department of the firm and, although formally independent, it is still seen as part of the organisation. The owners of the software house are the IS/IT manager/expert and one of the two owners of the manufacturing enterprise. In *FIRM 11*, the son of the CEO is one of the shareholders of the software house. This enables a strong collaboration between the software house and the manufacturing enterprise. Furthermore, *FIRM 11* was the first client of the



software house and the only manufacturing enterprise that uses the whole modules of the integrated software they sell. According to the managing director of the software house, is also in *FIRM 11* where the software works best. As he says, "*it is our case of success*".

Financial resources although limited do not represent a significant constraint to IS/IT adoption. *FIRM 1* bought their first CAD/CAM system second-hand with a bank loan and they were very successful with it. They even decided to buy the system without any clear idea about how they would pay for it. *FIRM 2* covers some of the costs of developing tailored software by selling their own software to other similar firms that are not direct competitors. In *FIRM 11*, government funding is used to develop software and purchase hardware. The firm is now waiting for support in order to buy new hardware but the general manager declares that if the money does not come they will invest anyway. The managers interviewed in the firms in *cluster A* state that IS/IT costs do not inhibit IS/IT development.

In these firms, some cases of resistance to change were reported but those were managed and solved by top managers' attitudes towards IS/IT adoption. A former senior manager (and shareholder) of *FIRM 1* explains: "*employees started to believe that it would be better not criticising the system. The ones that would do it would have to face us*". In *FIRM 11*, one employee was moved to another section of the enterprise because he was refusing to use IS/IT.

Firms in *cluster A* were innovative in adapting or developing specific software due to an internal context that enables IS/IT success, created by the top managers' attitude to the exploitation of IS/IT.

#### **6.4.1.2 - External Context**

There were no external consultants involved in the process of IS/IT adoption and use. In *FIRM 11*, the IS/IT professionals of the software house are the only consultants the firm has, but the CEO sees these people as employees of the firm because his son is one of the owners of the software house. In *FIRM 2*, the entrepreneurs clearly refuse any consultancy work. One of them expresses his opinion by saying that in the enterprise they are "the best consultants".

Vendors support is perceived as good in the three firms. This is due to the fact, explained by interviewees, that the development of IS/IT knowledge in-house improves the capability of the firm to negotiate with IS/IT suppliers. Another common issue to *FIRM 1* and *FIRM 2* is that these firms permanently put pressure on customers to adopt *interorganisational information systems*. Both enterprises are changing their internal processes by the use of EDI applications and suggest the use of these applications to the customers. Firms in *cluster A* did not report significant problems with the software



available in the market. They develop or order from IS/IT suppliers the systems they do not find in the market.

#### 6.4.1.3 - Process

All the firms in *cluster A* show a dynamic behaviour looking for new IS/IT. Although there are different strategies about IS/IT development, from in-house software development to IS/IT acquisition, in all cases IS/IT competencies were developed and IS/IT training provided. In *FIRM 1* and *FIRM 2* there are no formal techniques and methods for information systems planning, analysis or design. Only in *FIRM 11* the software house uses some IS analysis and design techniques. However, all these firms strategically control the development of their core IS/IT applications. In *FIRM 1* there is a high-technology small firm belonging to the group, whose main role is to test and apply new IS/IT to the business. In *FIRM 2*, the software that is critical for the business is developed in-house and, in *FIRM 11*, there is a strong family link between the owners of the manufacturing enterprise and the owners of the software house.

In all these cases, the CEO is supporting IS/IT adoption and relatively involved in it. However, in *FIRM 11*, although the CEO is supporting IS/IT adoption, he has a very low level of education (he is almost illiterate), which inhibits him from being more involved in IS/IT matters, as he wishes. He delegates that task to the general manager of the firm, who is the son-in-law of the other partner in the business. The general manager was involved in IS/IT adoption from the start. He collaborated with the IS/IT expert of the software house in the analysis and design of the whole manufacturing software of the enterprise.

#### 6.4.1.4 - Content

Firms in *cluster A* were early IS/IT adopters. The owners in these firms make an effort to use more advanced software and hardware, creating an environment suitable for IS/IT success. Therefore, enterprises in *cluster A* are more likely to have more sophisticated information systems fitting their business requirements. Two of the firms (*1* and *2*) have a comprehensive use of IS/IT in the business, including external integration through the use of interorganisational information systems. The other enterprise (*FIRM 11*) has an integrated software system supporting its core manufacturing processes. In terms of IS/IT objectives, *FIRM 1* and *FIRM 2* look at IS/IT as a way of providing competitive advantage. For example, in *FIRM 1*, the CEO expects that the use of *interorganisational information systems* will enable the firm to operate as a virtual enterprise, a key strategic objective of the organisation.



available in the market. They develop or order from IS/IT suppliers the systems they do not find in the market.

#### 6.4.1.3 - Process

All the firms in *cluster A* show a dynamic behaviour looking for new IS/IT. Although there are different strategies about IS/IT development, from in-house software development to IS/IT acquisition, in all cases IS/IT competencies were developed and IS/IT training provided. In *FIRM 1* and *FIRM 2* there are no formal techniques and methods for information systems planning, analysis or design. Only in *FIRM 11* the software house uses some IS analysis and design techniques. However, all these firms strategically control the development of their core IS/IT applications. In *FIRM 1* there is a high-technology small firm belonging to the group, whose main role is to test and apply new IS/IT to the business. In *FIRM 2*, the software that is critical for the business is developed in-house and, in *FIRM 11*, there is a strong family link between the owners of the manufacturing enterprise and the owners of the software house.

In all these cases, the CEO is supporting IS/IT adoption and relatively involved in it. However, in *FIRM 11*, although the CEO is supporting IS/IT adoption, he has a very low level of education (he is almost illiterate), which inhibits him from being more involved in IS/IT matters, as he wishes. He delegates that task to the general manager of the firm, who is the son-in-law of the other partner in the business. The general manager was involved in IS/IT adoption from the start. He collaborated with the IS/IT expert of the software house in the analysis and design of the whole manufacturing software of the enterprise.

#### 6.4.1.4 - Content

Firms in *cluster A* were early IS/IT adopters. The owners in these firms make an effort to use more advanced software and hardware, creating an environment suitable for IS/IT success. Therefore, enterprises in *cluster A* are more likely to have more sophisticated information systems fitting their business requirements. Two of the firms (*1* and *2*) have a comprehensive use of IS/IT in the business, including external integration through the use of interorganisational information systems. The other enterprise (*FIRM 11*) has an integrated software system supporting its core manufacturing processes. In terms of IS/IT objectives, *FIRM 1* and *FIRM 2* look at IS/IT as a way of providing competitive advantage. For example, in *FIRM 1*, the CEO expects that the use of *interorganisational information systems* will enable the firm to operate as a virtual enterprise, a key strategic objective of the organisation.



**Table 6.1 – Firms in cluster A**

	Case 1	Case 2	Case 11
<b>Firm / business</b>			
Industry and business characteristics	Mould industry (moulds for suitcases, electrical appliances and others). Generic strategy: differentiation by adding perceived use value to the service. The firm uses IS/IT to provide a complete customer service by manufacturing the whole set of moulds to produce a product.	Home-textiles (specialised in high quality bathroom rugs). Generic strategy: offering high perceived use value at higher prices. Top quality bathroom rugs, sold directly to small retailers and high quality stores. Orders received through EDI.	Footwear industry. Generic strategy: competing on price. About 85% of production is exported. The firm faces increased competition and the need to have lower prices.
Year of establishment	1975	1978	1964
Turnover and employees	£16 million; 450 employees	£4.8 million; 121 employees	£4 million; 123 employees
<b>1. Internal Context</b>			
• Organisational resources (financial and human)	Financial resources available for IS/IT investments. Since the establishment of the firm, IS/IT investments were enabled by a partnership with a larger firm. IS/IT development is perceived as a strategic issue and IS/IT cost is not a constraint on IS/IT investments. Qualified human resources. The firm has a training centre to develop their human resources, and supplies people and expertise for the local mould industry.	Available financial resources. The firm has been profitable and strongly oriented to IS/IT development. Although many employees have low levels of education, they are used to IS/IT because IS/IT was introduced since the set up of the firm.	Large investments were done in IS/IT. Government funds used to develop IS/IT. However, the CEO stated that we would invest in IS/IT anyway, except in CAD/CAM, which was too expensive compared to the benefits provided. Some problems with users' expertise to use computers, mainly the CAD/CAM system, were reported.
• Management perspectives and attitudes towards IS/IT adoption	The CEO sees IS/IT as an extremely important issue for the business and strongly supports IS/IT adoption. He is of the opinion that previous success of the business was also due to IS/IT adoption. The administration board is deeply involved in the process of IS/IT adoption and use.	One of the top managers/owners is very supportive to IS/IT adoption and use. He and the IS/IT expert/manager own a software house that develops software for the manufacturing firm.	The CEO recognises the importance of having new technologies and more specifically IS/IT. He is open to investment in IT. The son of the CEO, who is also a business partner of <i>FIRM 11</i> , holds a software house and a hardware firm, and that was important for the development of IS/IT in <i>FIRM 11</i> .
• IS/IT capabilities (IS/IT people and knowledge)	There is a high technology firm belonging to the group and several IS/IT experts able to develop or select software. The firm had a previous shareholder and top manager who was an IS expert. He and one of the two owners led the process of IS/IT development in the firm.	The firm developed internal IS/IT expertise. The IT expert/manager and one of the top managers own a software house employing three IT professionals. This enables the development of software for <i>FIRM 2</i> and for other firms in the industry ( <i>FIRM 2</i> does not have strong competitors in Portugal).	There is a strong link to a software house and a hardware supplier. This link is based on family ties and enables the necessary IS/IT expertise the firm needs.
• Organisational structure	Matrix structure, but with some characteristics of a holding company. The IS/IT manager is in a high hierarchical position. There are two owners (holding 50% each).	Simple structure, flat and very informal. The IS/IT expert/manager is not directly involved in business decisions. The firm is owned by two top managers and their families (holding 50% each).	There is a simple structure, with most intermediate management decisions concentrated on the general manager. The CEO (72 years old) is more of a supervisor, although important in critical decision making. The firm uses external accounting services.
• Power relationships (conflicts)	Initially, staff was not receptive to IS/IT adoption. However, top management put pressure on employees to use IS/IT and had an active role solving potential conflicts related to IS/IT.	IS/IT was introduced since the set up of the firm and people got used to it. No significant conflicts emerged from IS/IT adoption and use.	No significant conflicts reported.



	Case 1	Case 2	Case 11
<b>2. External Context</b>			
<b>External support</b>			
• IS/IT vendors' support	Perceived as good. Since the firm has prestige in the industry, local software houses are interested in being business partners.	No need for external expertise. Software is developed in-house.	There is a good vendors' support.
• Consultant effectiveness	No IS/IT consultants ever involved.	The top manager interviewed stated no need for external IS/IT consultants.	IS/IT consultancy is provided by the software house.
<b>IS/IT available (market)</b>			
• Quality of IS/IT available in the market	Not perceived as a problem.	The interviewees are of the opinion that manufacturing software needs to be specifically designed according to the requirements of the business.	Other software systems are perceived as inferior to the one the firm has.
• Quality of IS/IT external expertise & services	Difficult to find CAD/CAM experts. It takes some years to train staff in CAD/CAM.	Finding good IS/IT experts in the market was reported as difficult.	Since there is a strong link with a software house, the firm does not evaluate alternatives.
<b>Business Environment</b>			
• Business pressure to adopt IS/IT	The firm has an active role putting pressure on customers to adopt EDI based systems. The firm sees this as a service they provide to customers.	The firm puts pressure on customers (small retailers and agents) to send orders through the Internet. This is seen as very important for the business.	The firm did not get any suggestion from customers to adopt EDI.
<b>3. Content</b>			
• Type of systems	CAD/CAM, manufacturing planning, administrative systems and EDI based systems for on-line product design & development.	Manufacturing control in real-time, production planning, administrative software and reception of customers' orders using an Internet interface integrated with the main computer system.	A manufacturing system, a package for accounting and a CAD/CAM system. The firm is looking for IS/IT integration.
• IS/IT objectives	Provide a better and fast customer service by enabling partnership and increasing the quality of the product.	Reduce administrative and manufacturing costs, and provide good customer service.	Better organisation of the enterprise.
• Evaluation of IS/IT	No formal evaluation of IS/IT costs/benefits.	No evaluation of IS/IT costs/benefits. Managers do not even believe in it.	No formal evaluation of IS/IT costs and benefits.
• Time of IS/IT adoption	Early adopters. One of the first firms in the industry to adopt 3D CAD/CAM, in 1984.	Early adopters. Since the establishment of the firm there was an IS/IT professional working in the firm.	The firm installed the actual manufacturing system in 1990, although this systems has been recently improved.
<b>4. Process</b>			
• Stages followed in IS/IT development	IS/IT acquisition. Careful analysis of IS/IT investments involving the board. There was a software development team in the past, but nowadays managers believe it only worth developing in-house small programs.	In-house development. No IS/IT planning or formal IS analysis and design. IS/IT development follows business needs.	The software house followed the major phases in software development, including IS/IT analysis and design.
• Models & techniques used.	No formal models or techniques used for IS/IT development.	No formal analysis and design techniques. Coding usually built in Visual Basic.	The analysis was done by using structured analysis techniques.
• IS/IT training	IS/IT training provided. The firm holds a training centre, providing IS/IT courses for employees.	IS/IT training provided in-house by the IS/IT manager/expert.	The software house supplier has provided some IS/IT training.
• People involved	Key people: CEO, top managers, IT people.	Key people: One top manager/owner and the IT manager/expert.	Key people: A top manager, the son of the CEO (a business partner of <i>FIRMA II</i> ) and the IS/IT consultant/vendor.



## **6.4.2 - Cluster B (FIRMs 3 and 12 – see table 6.2)**

### **6.4.2.1 - Internal Context**

Firms in *cluster B* developed their IS/IT competencies a long time ago and have integrated software for their core processes. In both firms, specific software applications were developed fitting the manufacturing processes and the requirements of the business. In *FIRM 12*, the IS/IT people of the firm built the software. In *FIRM 3*, the firm was a major shareholder of a software house that developed computer applications for the firm. Despite the software house having been sold out, the firm still has a good business relationship with them, due to many years of working together. Furthermore, both CEOs are close friends. In *FIRM 3* there is also a computer centre with two full-time IS/IT professionals. These people do not develop software, they basically administer the computer system and provide technical support to users.

A difference between the firms in *cluster B* and the ones in *cluster A* is that in *cluster A* firms adopted more innovative IS/IT because the top managers were looking for better ways of gaining competitive advantage through IS/IT, independent of its cost. Although managers do not see IS/IT costs as a problem, the two firms in this cluster are more careful about investing in IS/IT. The amount of money invested may be a concern, slowing down the process of IS/IT adoption. These enterprises were not searching for “strategic” applications independent of their cost, as happened with *FIRM 1* and *FIRM 2* in *cluster A*. In *cluster B* firms were trying to find “key operational” applications that can improve business performance<sup>2</sup>.

The members of the board were involved in the process of IS/IT adoption and use and, according to the interviewees, they were very demanding, putting pressure on people to adopt IS/IT. In *FIRM 3* some resistance to change was found when the integrated software system was introduced. Top management commitment enabled the firm to overcome those problems.

### **6.4.2.2 - External context**

One issue that was not found in these firms is pressure put on customers to adopt new IS/IT applications, as happens in *FIRM 1* and *FIRM 2*. None of the firms in *cluster B* have reached a stage of external integration, neither are they looking for it.

In *FIRM 12*, the IS/IT manager is an external consultant and a former senior manager of the firm. Although he only comes to the enterprise once a week, he is still in charge of the IS/IT department.

---

<sup>2</sup> The concepts of “strategic” and “key operational” applications are discussed in Ward, John and Griffiths, Pat (1996). *Strategic Planning for Information Systems*, Wiley, Chichester.



In both firms, there is the perspective that there is no proper manufacturing software available in the market, and this is the main reason why computer applications were developed specifically for the firm. Since these enterprises already have IS/IT people in-house, or in a partner IS/IT enterprise, they do not put much effort into looking for external expertise or IS/IT services.

#### **6.4.2.3 - Process**

In one case (*FIRM 12*), software is mainly developed in-house, in the other (*FIRM 3*) it is developed by a preferred software house (which belonged, in the past, to the manufacturing firm). There is no use of formal models or techniques for IS/IT development (except computer languages). Computer programmers in *FIRM 3* showed lack of knowledge about systems analysis and systems design techniques. According to the interviewees, there is no IS/IT training in the firm, users learn by using the software. However, both firms have computer centres for users' support and top managers were involved in the process of IS/IT adoption in collaboration with the IS/IT professionals of the firm and experts from the partner software house (in *FIRM 3*).

#### **6.4.2.4 - Content**

The software was specifically developed to fit the business requirements of the firms. Almost all interviewees argue that manufacturing systems require specific software. Because manufacturing processes are different, this software must be adapted to the requirements of the manufacturing function. Both firms in *cluster B* have been operating in the industry for a long time and the integrated computer-based manufacturing systems were developed in the 1980s, using technology that is not up-to-date anymore.

### **6.4.3 - Cluster C (*FIRMs 4, 5, 7 and 10* – see table 6.2)**

#### **6.4.3.1 – Internal context**

Like the ones in *cluster B*, all firms in *cluster C* employ IS/IT experts. Some previous software was developed in-house but nowadays most software is developed by contracted software houses. Top managers/owners are willing to develop IS/IT and significant amounts of money are being invested. Financial resources are available and do not constrain IS/IT investments. Either the CEO (*FIRM 4* and *FIRM 10*) or a senior manager belonging to the family of the CEO (*FIRM 5* and *FIRM 7*) were deeply involved and in the process of IS/IT adoption and use.

There were some minor concerns with the quality of human resources in the older firms (*FIRM 5* and *FIRM 7*), but *FIRM 4* and *FIRM 10*, that were established more recently,

started employing younger people and human resources are perceived by managers as good.

#### 6.4.3.2 - External context

In some cases (4 and 10) customers were forcing the firm to use IS/IT and these firms responded well. There is a generalised perspective that the accounting software available in the market works well but manufacturing software must be specifically developed according to the specifications of the firm. Therefore, most of these firms do not even search carefully in the market for manufacturing applications. The quality of the software available in the market is not a major concern because interviewees believe that core manufacturing processes cannot be implemented using off-the-shelf software. In their opinion, manufacturing software must be developed in-house or contracted out to a software house.

#### 6.4.3.3 - Process

Enterprises in *cluster C* have different strategies for IS/IT adoption, which are:

- selecting an external software house to develop and implement a tailored and integrated computer system (*FIRM 5* and *FIRM 7*);
- purchasing core applications in the market and developing most of the other software in-house (*FIRM 10*);
- purchasing all software in the market or order software development in an associated firm (*FIRM 4*).

None of these firms reported the use of any formal systems analysis or systems design techniques. On the other hand, IS/IT training was provided in all firms. In some of the cases, the CEO was not directly involved in the process of IS/IT adoption (*FIRM 5* and *FIRM 7*). The *IS/IT project leader/champion* was a close member of the family of the CEO, a senior manager with power in the organisation.

#### 6.4.3.4 – Content

The most significant difference between firms in *clusters B* and *C* is the level of IS/IT sophistication. While firms in *cluster B* have their core manufacturing processes integrated, the ones in *cluster C* do not. Meanwhile, some firms in *cluster C* (*FIRM 5* and *FIRM 7*) tend to move forward by adopting more recent IS/IT and integrating their software applications. *FIRM 10* also wishes to implement integrated software systems but is not doing it yet.

Several IS/IT objectives were reported, with emphasis on cost reduction (including labour costs). Quick response time and better customer service are also seen as important. However, none of the firms were doing any formal evaluation of IS/IT benefits.



**Table 6.2 – Firms in clusters B and C**

	<b>Case 3 (Cluster B)</b>		<b>Case 12 (Cluster B)</b>	<b>Case 4 (Cluster C)</b>	
<b>Firm / business</b>					
<b>Industry and business characteristics</b>	Cement pipes and slabs. Generic strategy: competing on price. The firm operates mainly in the domestic market. A re-engineering process was carried out in order to increase competitiveness. Problems with the use of a raw material (asbestos).	Clothing industry. Generic strategy: competing on price but also competing by adding perceived use value on the service. The enterprise exports 100% of its production. Major customers are: Marks & Spencer, Levi Strauss, Diesel and Mark'O Polo.	Mould industry (moulds for the automobile industry and electrical appliances). Generic strategy: competing by adding perceived use value on the service. Fast delivery time is an important requirement in the industry and the firm provides it.		
<b>Year of establishment</b>	1945	1961	1993		
<b>Turnover and employees</b>	£9.2 million; 196 employees	£10 million; 350 employees	£11.2 million; 138 employees		
<b>1. Internal Context</b>					
• Organisational resources (financial and human)	Limited financial resources for IS/IT investments, although this is not seen as a significant constraint. The development of human resources was difficult and still is perceived as a weakness of the firm. IS/IT training was included in a European project.	Although top management knows the importance of IS/IT investments there was a period when the firm could not invest in IS/IT because of lack of financial resources. IS/IT costs are not perceived as a significant constraint to IS/IT development.	The firm is doing very well from a financial perspective and large investments including IS/IT are being planned. Qualified human resources. Because the firm is recent, most CAD/CAM operators are engineers. Several users have previous IS/IT experience.		
• Management perspectives and attitudes towards IS/IT adoption	IS/IT enabled a re-engineering process in the firm to rationalise procedures and reduce costs. The CEO and the finance manager strongly support IS/IT adoption and see it as a critical way to increase competitiveness.	Top managers do not have much IS/IT expertise and they support the decisions of the IS/IT manager/consultant.	The CEO supports IS/IT investments. He sees IS/IT as an important issue to compete in the industry. Relationships are informal and all employees are able to suggest IS/IT changes.		
• IS/IT capabilities (IS/IT people and knowledge)	There is an IS/IT department with two people but these are computer system administrators and do not develop software. A software house, founded and owned in the past by FIRM 3, provided software. Both CFOs are personal friends which enables a good business relationship.	Available. There is an IS/IT manager/consultant, who was a former senior manager of the firm. The firm also has two part-time and one full-time IT professionals.	The firm employs a large number of engineers with IT expertise. These people suggest IS/IT changes. The most important software is CAD/CAM, hence there is no significant in-house IS/IT development.		
• Organisational structure.	Functional structure. The firm has been flattening the structure. The IS/IT manager is the finance manager. The CEO is a professional manager. The firm is owned by several shareholders.	There is a functional structure. The enterprise is 100% family owned. The board of directors changed several times in the last few years. Recently, the organisational processes were restructured.	Functional Structure. The IS/IT manager (CAD/CAM systems manager) is a top manager. Capital belongs 100% to the CEO and his parents.		
• Power relationships (conflicts)	The CEO had an important role in avoiding conflicts related to IS/IT. According to the CEO, the profile of the computer systems administrator also helped solving conflicts.	The fact that users and the board are very demanding about IT services is perceived as a critical factor for IS/IT success. In the past, some negative attitudes towards IS/IT use were found.	The firm was recently established, employees are all very young, and there is an informal working environment. This is perceived as a reason why there are no internal conflicts related to IS/IT adoption and use.		
<b>2. External Context</b>					
<b>External support</b>					
• IS/IT vendors' support	There is a strong relationship with a software house that provides IT services and software. Managers have a good opinion about these services.	No use of external vendors, software is developed in-house.	Software is bought in the market. The IS/IT manager (CAD/CAM systems manager) has a major role in the software selection.		



	Case 3 (Cluster B)	Case 12 (Cluster B)	Case 4 (Cluster C)
• Consultant effectiveness	External experts provided computer training and management education.	Perceived as good. There is a strong link between the IT expert/consultant and top management in the firm (he was a former manager).	'Consultants' used only for IS/IT training.
IS/IT available (market)			
• Quality of IS/IT available in the market	Holding 40% of a software house led to the development of a tailored and integrated software solution by the software house.	According to the IS/IT consultant there is no good software available in the market for manufacturing, only projects or weak programs with fancy interfaces.	It is not seen as a constraint. There are CAD/CAM systems available (a critical software for the business). However, some difficulties were reported in the past, in finding programs to exchange data between CAD systems.
• Quality of IS/IT external expertise & services	Not a significant issue.	Since 1973, the firm has IS/IT experts in-house.	The firm hires young people with University degrees and then trains them in-house. This is seen as a success factor of the firm.
Business Environment			
• Business pressure to adopt IS/IT	Not suffering or putting pressure on customers to adopt IS/IT.	Levi Strauss suggested the use of EDI but it is not implemented yet.	EDI systems are available. The firm adopts new IS/IT as soon as it recognises business value in it, but does not put pressure on customers to use those systems.
3. Content			
• Type of systems	Integrated software for manufacturing management and administrative transactions.	There is an integrated software for manufacturing and administrative purposes developed in-house using RPG. Use of CAD.	CAD/CAM systems, administrative software and telecommunication technologies (including EDI), software for manufacturing planning & control.
• IS/IT objectives	Reduce organisational structure and costs; provide a faster customer service.	More efficiency.	Fast delivery time and mould precision.
• Evaluation of IS/IT	No formal evaluation of IS/IT costs/benefits.	No formal evaluation of IS/IT costs and benefits.	No formal evaluation of IS/IT costs/benefits.
• Time of IS/IT adoption	The IS/IT project started in 1986 but only in 1989 the firm was using an integrated management system.	Early IS/IT adopters, since early 70s.	The firm has been recently set up (1993) and IS/IT infrastructures were developed when the firm was set up.
4. Process			
• Stages followed in IS/IT development	Specific software developed by the partner software house or changed in-house by a computer programmer that works full-time for the associated software house and part-time for the firm.	In-house software development, using informal systems analysis.	IT acquisition. IT people evaluate carefully the software acquired in the market.
• Models & techniques used	Software is outsourced. None of the two IS/IT people in the firm are able to write computer code.	No formal analysis techniques used. Only MPG code.	No use of formal models or techniques for IS/IT management and development.
• IS/IT training	IS/IT training provided in the past by University lecturers.	There is no formal IS/IT training, people learn how to use the software by using it.	IS/IT training provided by well selected external experts.
• People involved	Key people: CEO, IS/IT manager (also finance manager), IT people and IS/IT experts from the software house.	IT consultant/manager, IT professionals, and the administration board for decision making.	Mainly the IS/IT manager plus other functional managers or IT experts. The CEO supports IS/IT adoption but does not get himself much involve in the process of IS/IT adoption and use.



	Case 5 (Cluster C)	Case 7 (Cluster C)	Case 10 (Cluster C)
<b>Firm/Business</b>			
Industry and business Characteristics	Clothing industry (knitwear). Generic strategy: offering high perceived use value at higher prices. About 1200 customers, small retailers. Sales orientated to the domestic market (only 5% exports). The firm faces a slow but increasing competition from large international retailers.	Textile industry (stamping). Generic strategy: competing on price. 50% of production is exported. The survival of the Portuguese clothing industry is a major threat for the business. The firm is making agreements with large retailers, so that they can recommend <i>FIRMA 7</i> to their customers.	Clothing industry (sports wear, shirts, trousers, ladies wear). Generic strategy: competing on price. 98% exports. It is a strategy of the firm to sell only for well known large multinational organisations like Nike, Adidas, Levi Strauss or Calvin Klein. No owned brand names.
Year of establishment	1983 (it was a fusion of three other firms).	1969	1989
Turnover and employees	£8 million; 290 employees	£12.8 million; 340 employees	£11.2 million; 160 employees
<b>1. Internal Context</b>			
• Resource availability (financial and human)	The firm had significant investments in IS/IT, around £220,000 in the last few years. Availability of financial resources for IS/IT investments is not seen as a problem. There were reported some minor problems related to IS/IT use because of the age of employees and their lack of IS/IT education.	From a financial perspective the firm is in a comfortable situation. Financial resources are not perceived as an inhibitor of IS/IT adoption. There were some references to lack of use of information for decision making by managers due to lack of expertise using IS/IT.	Financial resources are available and are not constraining IS/IT adoption. Perceived as good.
• Management perspectives and attitudes towards IS/IT adoption	Managers interviewed reported a strong support towards IS/IT adoption, although the CEO is not much involved in the process of IS/IT adoption. The development of IS/IT in the firm is led by his soon, an engineer with some previous IT education.	The owners of the firm have a passive attitude towards IS/IT adoption. They delegate it to the commercial manager, a close family member with some IS/IT expertise. The commercial manager is of the opinion that for IS/IT success it necessary to have a leader with the "capability" to "force" the adoption and use of IS/IT.	The CEO has a critical role in IS/IT development, supporting IS/IT adoption since the establishment of the firm, 9 years ago.
• IS/IT competencies (IS/IT people and knowledge)	Since a long time ago, the firm has had an IT department, with two professionals providing IT services. In the past, these people developed accounting software in-house. The manufacturing manager has some (limited) IS/IT education.	Software developed in-house. There is a computer centre with three IT professionals.	The firm always developed internal IS/IT capabilities, with early in-house software development. There are three IT people (two full-time and one part-time). Software is also acquired externally.
• Organisational structure	There was a management buy-out and the CEO owns 55% of the firm. The firm has a functional structure. The manager of each department (manufacturing or administrative) is responsible for IS/IT in his own area. The manufacturing manager (and son of the major owner and CEO) has a critical role in IS/IT adoption and is informally the IS/IT manager.	Functional structure. Family owned business. The owners are the wife and the mother-in-law of the commercial manager (the top manager interviewed), who has an active role in IS/IT development. The IT manager/expert is not involved in business decision making.	Functional organisational structure. Informal relationships. The CEO has some IS/IT knowledge and leads the process of IS/IT adoption.
• Power relationships	Not reported as a relevant issue.	There was some initial resistance to use IS/IT, solved over time.	All staff is very young and, according to the interviewees, show a positive attitude towards IS/IT adoption and use.



	Case 5 (Cluster C)	Case 7 (Cluster C)	Case 10 (Cluster C)
2. External Context			
External support			
• IS/IT vendors' support	The interviewees are satisfied with the services provided by the software house.	There is the perspective that the performance of IS/IT vendors is good but not "100%". IS/IT suppliers have scarce human resources to work on IS/IT projects.	According to the CEO, IS/IT vendors support is critical for IS/IT success.
• Consultant effectiveness	No consultants involved in IS/IT adoption.	Not reported as a relevant issue.	No use of consultants.
IS/IT available (market)			
• Quality of software available in the market	Interviewees state that software for manufacturing purposes needs to be developed according to the specifications of the enterprise.	There is the perspective that software for manufacturing needs to be adapted according to the specifications of the firm.	Manufacturing software packages do not work well. Managers believe that it is difficult to find good software for manufacturing systems.
• Quality of IS/IT external expertise and services	Not reported as a relevant issue.	Not reported as a relevant issue.	According to the CEO it is difficult to find IS/IT experts.
Business Environment			
• Business pressure to adopt IS/IT	There was no business pressure to adopt EDI because customers are small retailers. However, the firm is thinking about adopting EDI.	Not identified. According to a top manager, the firm works with products that may change everyday, hence it is difficult to adopt EDI based systems.	Customers put pressure to adopt IT based communication technologies, like EDI, and the firm responds well.
3. Content			
• Type of systems	There is an integrated software for administrative and manufacturing purposes, which includes a manufacturing control system in real time. The firm is also thinking about installing an internal EDI system.	The firm is preparing a large IS/IT investment: a Windows NT network running an integrated management software developed by a local software house to the specifications of the firm. The actual hardware and software (administrative and manufacturing) is obsolete.	Manufacturing planning, CAD/CAM and administrative software.
• IS/IT objectives	Reducing people in the administrative and manufacturing areas. Enabling a better response time and customer service.	Provide accurate information about sales analysis, sales statistics, and cost evaluation.	Reducing costs.
• Evaluation of IS/IT	No formal evaluation of IS/IT benefits.	No formal evaluation of IS/IT benefits.	No evaluation of IS/IT benefits or IS/IT costs.
• Time schedule	The firm is an early IS/IT adopter, since its establishment.	First PC purchased in 1983. In 1986, the central computer system was installed (for administrative applications), and manufacturing orders were included in 1991.	IS/IT adopters since the firm was set up, in 1989.
4. Process			
• Stages followed in IS/IT development	The interviewees identified a systems analysis phase.	Software acquisition is the dominant phase although some minor applications are developed in-house.	The CEO and the IS/IT people carefully evaluate in-house development and software acquisition.
• Models & techniques used	Not identified by the IT person.	No formal techniques used by IS/IT people in the firm. Visual basic used in application development in-house.	No formal analysis and design techniques. Visual basic used.
• IS/IT training	Provided by IS/IT vendors.	IS/IT training provided, in 1992, with funds from a European project.	People attend several courses, including IS/IT courses.
• People involved	Key people: manufacturing manager, finance manager, IT people, and IS/IT experts from the software house.	Key people: commercial manager, IT people, IS/IT experts from the software house.	Key people: CEO, IT people, IS/IT vendors.



#### **6.4.4 - Cluster D (FIRMs 6, 8 and 9 – see table 6.3)**

##### **6.4.4.1 - Internal context**

In all the firms in *cluster D* there is some, however limited, IS/IT expertise. In these enterprises, the CEO does not have IS/IT knowledge and is not involved in the process of IS/IT adoption. Another common issue is a situation of power conflict between the finance manager and the manufacturing manager which affects IS/IT adoption and use. In *FIRMs 6* and *9*, these conflicts are very clear and due to lack of involvement of the CEO in the process of IS/IT adoption.

In all these firms, the person responsible for IS/IT is the finance manager and there are significant differences of opinion, about IS/IT matters, between him and the manufacturing manager. In both *FIRMs 6* and *9*, the software house expert pointed out these conflicts as a problem that inhibits the successful adoption and use of IS/IT in the enterprise. In *FIRM 8*, the finance manager stated that he has problems trying to make other people adopt the manufacturing software purchased by the firm. The finance manager is the *IS/IT project champion* but he does not have enough power to force others to co-operate in IS/IT implementation. He is a young professional, relatively new in the organisation while most of the other managers have been in the firm for a long time and are relatives of the CEO. Therefore, the project is going very slowly and with significant problems due to some resistance to change clearly identified by both the finance manager and the software house expert.

##### **6.4.4.2 - External context**

Firms in *cluster D* have a similar *internal context* and differ basically in terms of *content*, *process* and *external context*. A common feature amongst the firms in the *clusters A, B* and *C* is that most managers revealed that, when selecting IS/IT suppliers, they were more concerned with the competencies of the people working for the supplier than with the quality of the software they were buying. This was not noticed in *cluster D*. A good example can be found in case study 9. When the enterprise had to choose between two software products, they selected the one that had more potential from a technological perspective without looking at the availability of technical support.

##### **6.4.4.3 - Process**

Software acquisition assumes a relevant role in IS/IT adoption. In none of the three firms “key operational” software is developed in-house and significant problems occur trying to adapt manufacturing software to the business. In case study 6, the manufacturing firm is now just thinking about purchasing manufacturing software, but the interviewees are of the

opinion that the implementation of this software will be difficult. In *FIRM 8* and *FIRM 9* implementation problems also occurred due to lack of top management involvement.

#### **6.4.4.4 - Content**

In *cluster D*, the *content* also helps to explain the low level of assessed IS/IT success. *FIRM 6* is a small firm, with 51 employees and £6.4m turnover, and since it operates in the wine industry the manufacturing processes are not very complex. Therefore, manufacturing information systems, although important, are not essential for the firm. Compared to *FIRM 8* and *FIRM 9* (this latter operates in the same industry but is three times bigger in turnover and number of employees), *FIRM 6* is less demanding in terms of IS/IT products and services. Since it has relatively low levels of IS/IT adoption, interviewees are not too much disappointed with IS/IT. However, it was clear in the interviews that the *internal context* of the firm inhibits the development of software to support its core manufacturing processes.



**Table 6.3 – Firms in cluster D**

	Case 6	Case 8	Case 9
<b>Firm/Business</b>			
Industry and business characteristics	Wine industry. Generic strategy: competing on price. Most of production is sold in the domestic market to large retail stores. The firm has its own distribution system.	Footwear industry. Generic strategy: competing on price. 95% of production is exported mainly to large European retailers (UK, 40%), like Clarks, usually using customer's brand name. The firm has its own brand name in the domestic market (5% of sales).	Wine industry. Generic strategy: competing on price and offering high perceived use value at higher prices. 50% of production is exported to Europe (quality wines) and USA (low price rosé wine) with own brand names. The firm also produces <i>superior quality</i> wines sold in the domestic market.
Year of establishment	1964	1959	1834
Turnover and employees	£6.4 million; 58 employees	£6 million; 250 employees	£20 million; 165 employees
<b>1. Internal Context</b>			
• Resource availability (financial and human)	The firm had some financial problems in the recent past and IS/IT investments were affected by that. However, IS/IT costs are not seen as a major constraint to IS/IT investments. According to the software supplier, users have experience in using IS/IT.	The financial situation of the firm is good. The firm has been profitable and is one of the best in the footwear industry. However, finance resources are seen as an inhibitor of IS/IT adoption (limited budget). Users have low levels of education and are not committed enough to using IS/IT in their tasks.	Cost is not a constraint to IS/IT adoption. The firm is willing to pay if the computer system provides the information the firm needs. There is lack of knowledge about how to use the integrated software (MFG/PRO).
• Management perspectives and attitudes towards IS/IT adoption	Although it was reported that the board supported IS/IT investments, since there are many shareholders, the board seems to avoid taking risks, and delays IS/IT decisions, being afraid of making mistakes and receiving criticisms from the shareholders.	There is a conflict of perspectives. The firm is a traditional family business, the entrepreneurs/owners are not young (the CEO is 71 years old) and are not committed to IS/IT adoption. Although the finance manager supports the use of IS/IT, it has been difficult to implement IS/IT in the firm.	The CEO was never much involved in processes of IS/IT adoption and there are conflicts of perspectives between the manufacturing manager and the finance (and IS/IT) manager. Conflicts related to IS/IT adoption are the result of lack of leadership and IS/IT strategy.
• IS/IT competencies (IS/IT people and knowledge)	The firm never had a full-time IS/IT person. There is very little IS/IT knowledge in the firm. Only one person has some IS/IT expertise.	There is a computer programmer that helps to solve IT problems but does not work full-time in IS/IT. This person aspires to working only in software development.	Only recently, in 1994, the firm started to hire IT people. After having problems with IS/IT adoption the firm started developing internal IS/IT competencies. The CEO has low IS/IT expertise.
• Organisational structure	The firm is an association of co-operatives of wine producers. The board of directors are not executives and only meets in the firm once a week. The finance manager and the manufacturing manager have a major role in IS/IT development.	Family business with a functional structure and informal relationships. The CEO and his brother are the owners of the firm. Almost all managers and administrative staff are family members. No formal IT department/office.	Functional structure. Traditional family-owned business. The CEO and his brother are the major owners of the enterprise (6 <sup>th</sup> generation of the founder). The IT department has two people and depends on the finance manager (IT manager).
• Power relationships	Internal power conflicts between the manufacturing manager and the finance manager were reported to affect IS/IT development. Although some negative reactions to IS/IT use have occurred in the past, nowadays employees show a more positive attitude towards IS/IT use.	Some interviewees are of the opinion that people are not committed enough to IS/IT adoption, as a reflex of owners' attitude of not giving much importance to IS/IT. Employees may fear losing their competencies.	There are conflicts of perspectives between the manufacturing manager and the finance/IS/IT manager in what concerns IS/IT adoption. Users show a passive attitude towards IS/IT adoption and data is not inputted in the computer because employees know it will not be used.
<b>2. External Context</b>			
External support			



	Case 6	Case 8	Case 9
• IS/IT vendors' support	Vendors support is reported as satisfactory, but according to the finance manager they take too much time to solve problems, through lack of resources.	Satisfied with vendors' support.	One of the reasons why the adoption of MFG/PRO failed was due to a poor representation of the software in Portugal.
• Consultant effectiveness	Software house professionals are the IS/IT consultants.	No use of IS/IT consultants.	Consultants could not solve IS problems.
IS/IT available (market)			
• Quality of software available in the market	It was reported that there was a need for better software solutions, mainly in manufacturing. However, there is low knowledge about the software available in the market.	According to the IT person, there is good software available, but manufacturing software always needs to be adapted.	For manufacturing there is the need to adapt software to the specifications of the firm. Good administrative software is easier to find.
• Quality of IS/IT external expertise & services available	The finance manager does not have a good opinion about the IS/IT services available in the market.	Not reported as a relevant issue.	Not reported as a relevant issue.
Business Environment			
• Business pressure to adopt IS/IT	Some large retailers are demanding EDI systems which the firm is implementing.	Customers never suggested the use of <i>interorganisational information systems</i> .	Customers did not exert pressure to adopt IS/IT.
3. Content			
• Type of systems	There is a package for accounting that is complemented by a specific software to manage stocks and invoicing.	Accounting package, manufacturing modelling and planning (developed in-house). A new software developed by a local software house will replace the existing manufacturing application.	A powerful integrated software system (MFG/PRO), supporting transaction processing and manufacturing tasks. However, the system is not well used.
• IS/IT objectives	The main objective of IS/IT in the firm is to provide faster data processing in accounting and stock management.	Reducing and evaluating manufacturing costs.	Better stock control and financial analysis.
• Evaluation of IS/IT	No formal evaluation of IS/IT benefits.	No formal evaluation of IS/IT benefits.	There were never defined specific objectives to be achieved by IS/IT.
• Time schedule	The firm has used IS/IT since the 1980s but it has low levels of IS/IT adoption.	Late adopter.	Slow adoption process.
4. Process			
• Stages followed in IS/IT development	Basically software acquisition with some IS analysis has been done by the software supplier in order to adapt the software to the firm.	Software acquisition is the major phase.	Acquisition. The firm does not develop software in-house except small programs.
• Models & techniques used	Software is not developed in-house. The IS/IT vendor uses some structured analysis techniques for software development.	No formal analysis and design techniques. Some code was developed in Fox (a relational database management system for PCs).	No use of formal techniques or frameworks.
• IS/IT training	No formal IS/IT training. "People learn by using the computer".	Funds from a European project were used for IS/IT training.	No. The finance manager (and IT manager) argues that users must first start to learn by themselves how to use IT.
• People involved	Since the members of the board are not executives, the manufacturing and the finance manager are very important in the process of IS/IT adoption. People from the software house were also involved.	Key people: finance manager, software house experts.	Key people: finance and manufacturing managers, IT person, IS/IT vendors.



6.5 - Cluster sensitivity analysis

The firms studied were previously clustered according to their levels of IS/IT adoption and assessed levels of IS/IT success. However, grouping firms that are obviously different is never a perfect task because in any classification one tends to emphasise similarities and minimise existing differences. Therefore, even firms within the same cluster show significant differences. In this section, some of those differences will be analysed and other clustering alternatives evaluated. The clustering alternatives defined in this section emphasise more the level of IS/IT adoption by grouping and comparing firms with similar levels of IS/IT adoption. This tends to minimise more subjective aspects related to the assessed levels of IS/IT success that may influence the scope of the clusters initially defined. Figure 6.2 shows the four cluster alternatives that will be analysed in this section.

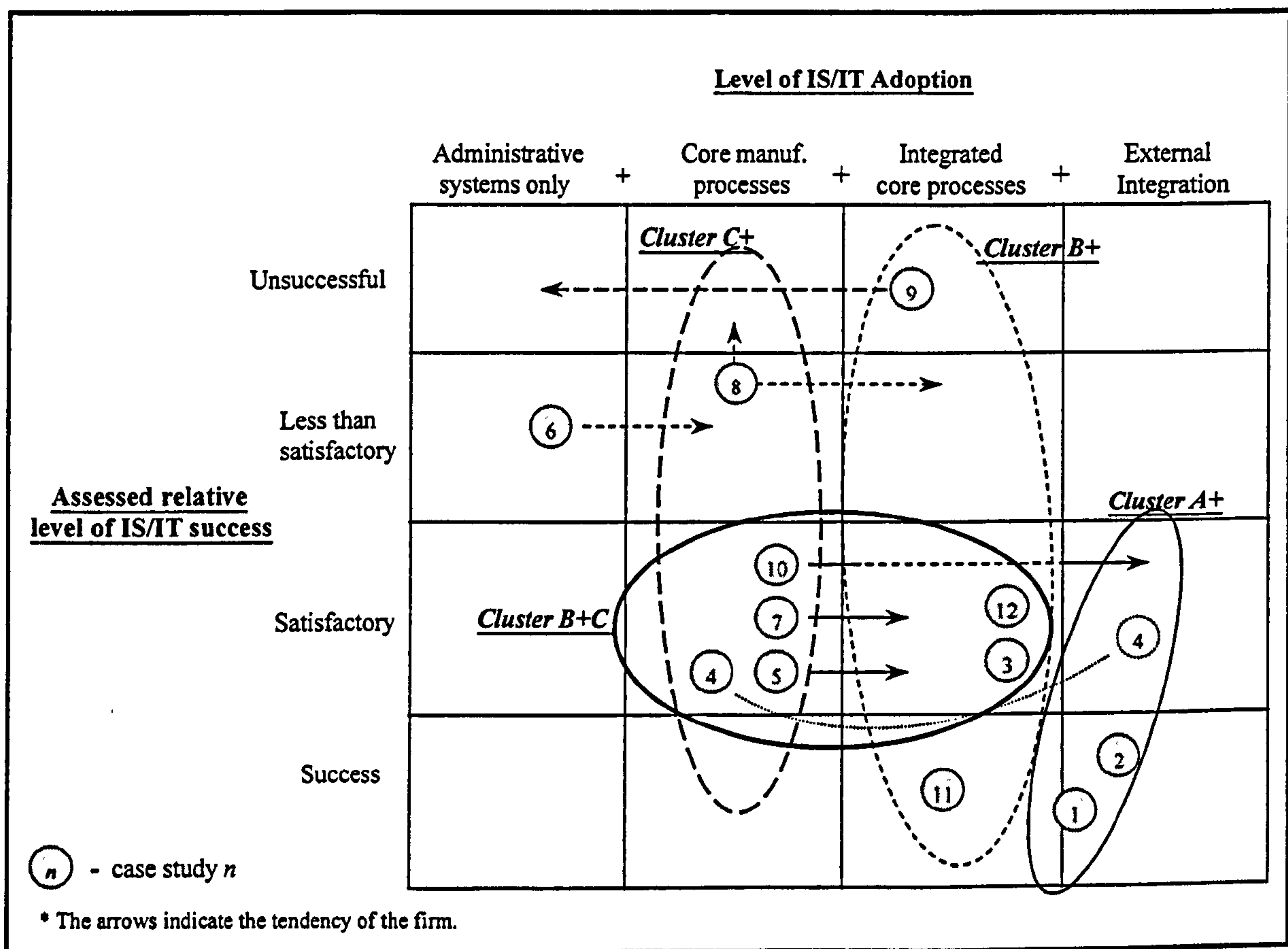


Figure 6.2 – Alternative clusters.  
Source: Compiled by the author.

### **6.5.1 – Cluster A+ : Firms in the stage of external integration (FIRMs 1, 2 and 4)**

Although *FIRM 1* and *FIRM 2* (*cluster A*) operate in completely different industries, top managers have a similar strategic perspective on the role of IS/IT in the business. They continually search for new IS/IT applications that may fit their business requirements. In *FIRM 11*, like in some of the firms in *clusters B* and *C*, IS/IT is used to improve the efficiency of the existing operations. This is likely to explain why *FIRM 1* and *FIRM 2* are now moving to external integration and *FIRM 11* is not. However, *FIRM 11* has an export company as a business partner. This export company buys a large percentage of the production of *FIRM 11* and has a more dynamic behaviour in terms of IS/IT adoption. It uses sophisticated IS/IT, including EDI systems, to communicate with customers. This company is owned by a son of one of the owners of *FIRM 11*. Furthermore, the owner of the export company is also one of the shareholders of both the software house and the hardware supplier of *FIRM 11*. These links with the export company and with the IS/IT enterprises enable *FIRM 11* to get access to IS/IT solutions without having to search for them.

Using Miles and Snow's (1978) framework, *FIRM 1* and *FIRM 2* in *cluster A* can be classified as *prospectors* because they permanently look for innovative IS/IT solutions that can be applied to the business, while firm *11* behaves more as a *defender*, adopting existing computer systems to improve efficiency. However, looking at *FIRM 11* within its network environment, including the export company and the IS/IT supplier, one concludes that as a whole this network of firms displays the characteristics of a *prospector*.

*FIRM 4*, in *cluster C*, also has external integration. Although independently managed, the firm is also part of a network of enterprises and uses some of the computer technology available in the group. According to Miles and Snow's (1978) framework, *FIRM 4* could be classified as an *analyser*. It has a dynamic behaviour searching for new IS/IT applications in the area of CAD/CAM but not so much for other administrative or manufacturing software. The latter ones are stable and operate below expectations (some problems with the administrative software were reported). The level of assessed IS/IT success was also lower than in the firms in *cluster A*.

### **6.5.2 – Cluster B+ - Firms using integrated software systems for their core processes (FIRMs 3, 9, 11, 12)**

Although *FIRMs 9, 3, 12* and *11* have all tried to implement similar computer systems, to integrate their core processes, *FIRM 9* has not succeeded. To some extent, the nature of the software system implemented by *FIRM 9* was different. *FIRM 9* tried to adopt a powerful software product, called MFG/PRO, while *FIRMs 3, 11* and *12* started developing their computer software from scratch. *FIRM 9* bought a powerful software system without having IS/IT knowledge to manage its implementation while the other firms had to



develop their own IS/IT competencies in order to create the software. In *FIRMs 3* and *11*, these IS/IT competencies were provided by associated IS/IT enterprises. However, there was a strong link between these manufacturing firms and the associated IS/IT enterprises. *FIRM 3* was a major shareholder of the IS/IT supplier and in *FIRM 11* there was a close family link between one of the owners of the manufacturing firm and the owner of the software house.

#### 6.5.3 – Cluster C+ - Firms using non-integrated manufacturing software (*FIRMs 5, 7, 8, 10*)

*FIRM 10* is now also looking for external integration and started to implement EDI systems. This firm has the profile of a *prospector* but is still looking for IS/IT solutions. Attending to top management perspectives and attitudes towards IS/IT adoption, *FIRM 10* is likely to move, in the future, further down in the grid presented in figure 6.1, into *cluster A*. The same may happen to *FIRM 5* that is now implementing an integrated software system. However, this last one is not looking for external integration. This is because the firm sells its products mainly to very small retailers operating in the domestic market.

*FIRMs 5* and *7* are also trying to adopt integrated software for the core processes of the firm. However, while in *FIRM 5* and *FIRM 7* top managers are strongly committed to the process of IS/IT adoption and use, in *FIRM 8* the CEO is not much involved, nor were most of the other senior managers. Hence, this is reflected in the attitudes of the users that, according to the finance manager and the IS/IT supplier, do not collaborate in the implementation of the computer system as they should. Moreover, the integrated software system that *FIRM 8* is trying to implement, with considerable delays and problems, is similar to the one that is successfully working in *FIRM 11* (the product is the same, sold and installed by the same IS/IT supplier).

#### 6.5.4 - Cluster B+C – Firms in clusters B and C (*FIRMs 3, 4, 5, 7, 10, 12*)

Firms in *clusters B* and *C* have in common the assessed level of IS/IT success and there are some factors that are interesting to compare. All these firms developed IS/IT knowledge in-house and top managers were committed to the process of IS/IT adoption and use. Nevertheless, in *cluster C* software is mainly developed by contracted software houses, while in *cluster B* software was developed in-house by the IS/IT experts of the firm (*FIRM 12*) or by an associated IS/IT enterprise (*FIRM 3*). The software systems available in the firms in *cluster B* are more stable and nowadays these firms have fewer tendencies to invest in IS/IT and look at IS/IT costs more carefully. In *cluster C*, managers want to move forward and integrate their computer systems. In this cluster, IS/IT costs are not seen as an important factor inhibiting IS/IT adoption.



## **6.6 - Initial findings from cluster analysis**

Initial findings from the cluster analysis suggest that an understanding of the *internal context* is extremely relevant to the understanding of IS/IT success in the SMEs studied. Firms in different clusters, implementing similar types of computer systems, in a similar *external context* and using similar processes of IS/IT adoption, are located in opposite clusters according to the assessed level of IS/IT success. This is the case of *FIRMs 8 and 11*. Other significant examples can be found in *FIRMs 1, 2 and 9*, showing how the *internal context* shapes the perceived level of IS/IT success in SMEs across different industries.

Furthermore, in the case studies presented, the process of IS/IT adoption is usually conducted in a similar way, not following a methodological approach, using informal methods and improvised techniques. The external context tends also to be identical in some of the enterprises studied that are located in the same area and operate in the same industry or in a similar industry.

The development of internal IS/IT competencies and management perspectives and attitudes towards IS/IT adoption and use seem to be extremely relevant to understanding IS/IT success. The development of IS/IT competencies and a top management supporting the process of IS/IT adoption and use in the business seems to provide superior levels of satisfaction with IS/IT in the manufacturing SMEs.

## **6.7 – Factor analysis**

The analysis of the data led to the identification of several groups of factors affecting IS/IT success according to their influence on the process of IS/IT adoption and use. These groups were termed: *situational factors*, *determinant factors* and *consequent factors*. Some of the factors previously identified in the literature and included in the framework did not seem to be significant or, at least, directly related to IS/IT success. Figure 6.3 presents these groups and associated sets of factors that will be subsequently explained.

*Situational factors* are prerequisites that are important for IS/IT adoption and use but are not critical to achieving IS/IT success. These factors include: financial resources, human resources (users), quality of the software available in the market, quality of IS/IT external expertise and services available, type of IS/IT, IS/IT objectives, and time schedule of IS/IT adoption.

*Determinant factors* are those that appear to explain relative IS/IT success. Data collected in the fieldwork provided evidence that these factors actually determine why some firms are more successful than others with IS/IT adoption and use.



*Consequent factors* are those that result from prerequisites (situational factors) and determinant factors. These include: users’ attitudes, power relationships, IS/IT vendors’ support, business pressure to adopt IS/IT, the people involved in the process of IS/IT adoption, and IS/IT training.

Some factors currently pointed out in the literature as related to IS/IT success were not found in this research as relevant to explain the level of IS/IT success. These factors were classified as *not significant factors*.

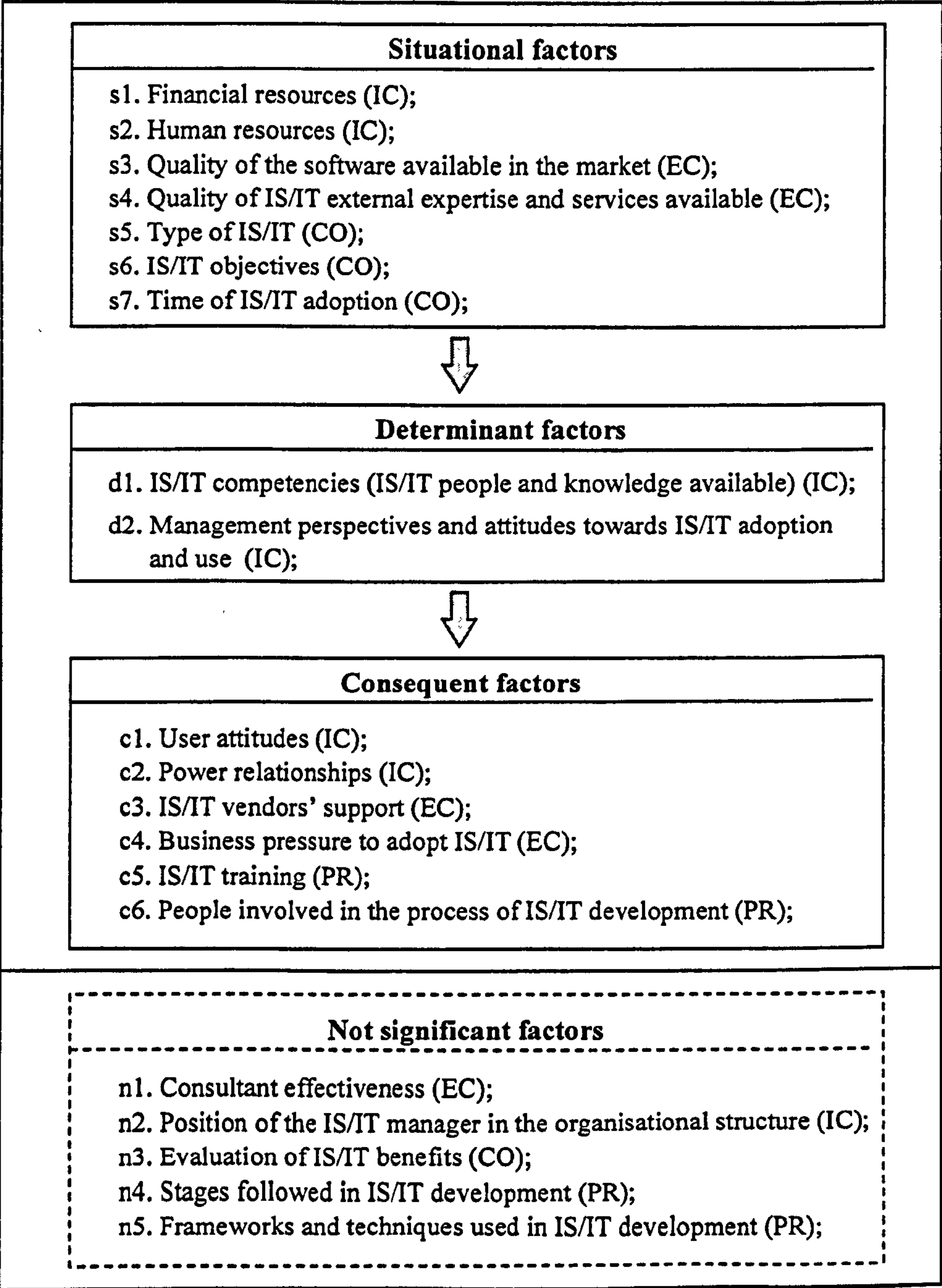


Figure 6.3 – Classification of factors associated with IS/IT success  
 Source: Compiled by the author

### 6.7.1 – Situational factors

#### s1) Financial resources

Lack of financial resources was not stated by interviewees as a significant constraint to IS/IT adoption. The CEO in *FIRM 10* declares that *“in our case, it is not cost that inhibits IS/IT development. Cost does not impede us from doing anything...this firm has huge IS/IT costs. It is difficult to say exactly how much”*. In most firms top managers hold a similar perspective.

However, in some cases, like *FIRM 12*, lack of financial resources was limiting IS/IT investments. In *FIRM 8*, although the firm has been profitable, IS/IT costs are also seen as a significant issue constraining IS/IT investments. On the other hand, in *FIRM 1*, where managers showed high levels of satisfaction with IS/IT, the firm made large investments in IS/IT without having enough money, using bank loans. The CEO of *FIRM 1* summarises his point of view by saying that:

*Being underdeveloped is an advantage as long as we have the right strategy, because the cost of investing in the technology of the XX century is low and the important thing is the ability to change, to differentiate. (CEO of FIRM 1)*

It is also interesting to note that *FIRM 9*, an enterprise that presented very low levels of satisfaction with IS/IT adoption and use, was the one that invested most. As the financial manager of *FIRM 9* explains, *“cost is not an inhibitor of IS/IT development. We are willing to pay if the new system provides the information we need”*.

For most firms studied, lack of financial resources is not perceived as a significant inhibitor of IS/IT investments, nor do these firms perform any type of formal cost/benefit evaluations to support IS/IT investments. An accurate cost/benefit evaluation is almost an impossible task. Most costs and benefits are difficult to measure, although according to Mintzberg (1994) managers frequently show a pronounced tendency to favour strategies emphasising measurable operations over strategies based on innovative and less measurable issues. Mintzberg (1994) also argues that strategic decision making tends to be informal, visionary, irregular and instinctive. Evidence suggests that top managers in the SMEs studied decide to invest in IS/IT according to their ‘beliefs’ about the potential benefits that they may get from IS/IT, without any formal and precise cost/benefit analysis of IS/IT investments.

#### s2) Human resources – users

Some firms reported problems with IS/IT because users were not qualified to use computers properly (*FIRMS 1, 3, 5, 8, 9, 12*). However, these problems were solved in most cases by top management intervention, providing IS/IT training to the users. Amongst these firms there are some that reported *success* using IS/IT. In *FIRM 1*, when



the firm introduced a new 3D CAD/CAM system, local young people without much IS/IT or manufacturing expertise were hired and trained to project moulds using the new 3D CAD/CAM software while the other technicians were still operating in 2D and doing other tasks. Top managers believed that the employees that used to work (and think) in 2D would never be able to operate properly with the new software. As the CEO of this firm says:

*We made a strong effort to learn how to work with IS/IT... We forbade operators to use 2D CAD and we started to have an exceptional capability to work in 3D, and that was a relevant strategic element.* (CEO of FIRM 1)

This attitude from the board contributed to solving a problem of resistance to change and enabled the firm to add another organisational capability, to project moulds in 3D. In the adoption of other types of IS/IT the board was always involved and put pressure on the staff to use those computer systems.

In FIRM 3, in spite of an initial reluctance of employees to work with the new integrated software, the system started to be used due to a strong management involvement. The CEO was committed to the process, not accepting any type of excuses about not using the computer system properly. He forced people to use the computers in the organisation. The finance manager (also the manager responsible for IS/IT) reveals that:

*For some people, if someone talked about IS/IT they almost got sick; others used to have other excuses, they might say that they could not use the computer because of their eyes; other ones did not have any skills or desire to use IS/IT. However, a favourable environment was created in order that everyone could naturally learn how to use the system.* (Finance & IS/IT manager of FIRM 3)

### s3) Software available in the market

Almost all interviewees declared that it is easy to find good software for administrative purposes in the market but manufacturing software must be specifically designed for the firm. They are of the opinion that there is no software available that could fit the existing manufacturing processes. For example, the IS/IT manager of FIRM 12 who is also an IS/IT external consultant explains this problem in his firm.

*We have always been interested in buying software instead of developing our software in-house, but there is none available. It does not exist! The market does not offer software for this industry or, when it offers, prices very high which will make us dependent from IS/IT suppliers. Those conditions are impossible for this type of firm.* (IS/IT manager/consultant of FIRM 12)

Interviewees in other firms hold a similar view. The CEO of FIRM 10 also confirms this problem.



*We have already seen some products that exist in the market but we were not happy with them... We keep buying software and linking it with ours. It is cheaper than develop it in-house but, unfortunately, we do not find many good software products. (CEO of FIRM 10)*

Because managers believe that the manufacturing software available in the market does not fit their business requirements, many firms do not even evaluate the existing options in the market and develop software in-house or look for software houses to contract out their manufacturing applications. The *software available in the market* is classified as a situational factor because, although influencing the level of IS/IT satisfaction, it is a prerequisite and does not contribute significantly to explain why some firms are more successful than others in IS/IT adoption and use. In two of the firms that assessed relatively lower levels of IS/IT success (*FIRM 8* and *FIRM 9*), the quality of the software available in the market was not perceived as a significant constraint. Moreover, the software installed by *FIRM 8* is basically the same that is installed in *FIRM 11* (the same product, from the same supplier), and *FIRM 11* is one of the cases of success.

#### s4) IS/IT external expertise and services available in the market

Some firms reported that it is not easy to find in the market good IS/IT experts and services. A director in *FIRM 1* expresses this by stating that “*the main problem with the use of IS/IT in the firm is lack of qualified people*”. This problem is more likely to happen in the smaller manufacturing firms that are located in places with more difficult access, in the countryside, not near any town or city. However, some of these firms, although revealing problems finding IS/IT services and people, were able to get those, while some other counterparts better located and with more financial resources available did not. For example, in *FIRM 10*, although the CEO/owner of the firm declares that “*it is difficult to get qualified IS/IT experts*” he has an IS/IT department with three IT professionals and he is satisfied with the process of IS/IT adoption and use in the firm.

#### s5) Type of IS/IT

According to the interviewees, administrative software, like accounting packages, is available in the market and is easy to implement. Problems occur when trying to adopt and use manufacturing software: production planning systems, manufacturing control in real-time, MRP, PDM, etc. Most interviewees state that manufacturing systems are more complex and need to be adapted according to the manufacturing processes of the firm. Interviewees also perceive CAD/CAM as expensive and requiring the use of IS/IT experts.

The IS/IT expert of one of the firms in *cluster A* argues that having specifically designed software in manufacturing is critical for their business, since these applications are the core software of a manufacturing enterprise.



*I do not believe in packages for production management and control in manufacturing SMEs. They have no chance... if we had standard software we would be dead, but completely dead (IS/IT person of FIRM 2).*

A similar opinion can be found in almost all the other firms, even in the ones that were less successful in adopting and using IS/IT.

*We bought software that was designed for a footwear firm. However, each firm must adapt it to its own characteristics. (Finance manager in FIRM 8, a footwear firm)*

Software integration is also seen as a major challenge for many firms. Examples can be found in *FIRMS 5* and *8*. The type of systems the firm uses is likely to influence the perceived level of satisfaction with IS/IT performance. In this research, all firms except one (*FIRM 6*) had manufacturing software systems implemented, but *FIRM 6* was thinking about doing so, and some small routines for manufacturing support were already implemented.

#### s6) IS/IT objectives

IS/IT objectives define the type of systems to be implemented and management expectations about what the firm may get from IS/IT. In *FIRMS 1* and *2* (two firms that were successful), the top managers interviewed see IS/IT as a strategic tool with a significant impact within the organisation and put efforts into achieving IS/IT objectives. In *FIRM 1* the CEO sees the installation of the new *interorganisational information system* as a way of enabling collaboration with customers and make the firm look like a virtual enterprise. Furthermore, he states that “*the concept of virtual enterprise is nowadays the most important strategic element for us... The fact that we have those systems before the customer gives us an advantage to learn*”.

In case study 2, the firm tries to provide a top quality product, through fast delivery time. IS/IT objectives are related to reducing costs and providing fast delivery time. The use of IS/IT is seen as a way of achieving the business strategy. As one of the owners says, “*IS/IT development follows the strategy of the firm*”.

However, in all firms studied, including the ones that were more successful with IS/IT adoption and use, IS/IT objectives were always broadly defined and there is no precise evaluation of their achievement.

#### s7) Time of IS/IT adoption

It was expected that firms that were established more recently may get advantages from that, because they are able to hire people with better qualifications and implement modern IS/IT. This is very clear in *FIRM 4*. Since *FIRM 4* operates in the mould industry, CAD/CAM is a core application to project moulds. The firm was established in 1993 and, unlike their competitors in *FIRM 1* (an older firm), almost all CAD/CAM operators hold a



first degree in engineering. Top managers (including the CEOs) in both *FIRM 1* and *FIRM 4* see this as a significant advantage. The CAD/CAM systems manager, also the manager in charge of IS/IT, explains his point of view by saying that:

*The main problem with the implementation of IS/IT may be the adaptation of people to new technologies ... That cannot be found in FIRM 4 because it is a newly set up enterprise and workers are relatively young.* (CAD/CAM systems manager of *FIRM 4*).

On the other hand, the Portuguese legislation protects employees more than in most Western countries and only in a few circumstances can they be fired. Dismissing employees has important social implications and can have a negative impact on the image of the organisation.

Furthermore, early IS/IT adopters may use out-of-date technology. This happens in *FIRM 12*. Although the firm uses an integrated software system developed in-house, in RPG, that is out-of-date, it would not be easy to replace it by modern software because, according to interviewees, much of the work previously done would have to be discarded.

Although the *time of IS/IT adoption* is not a critical issue for IS/IT success (for example, *FIRM 1* showed higher levels of assessed IS/IT success than *FIRM 4*), it is relevant to understanding IS/IT success. It is classified as a *situational factor* because the enterprises that were established more recently can start implementing more up-to-date information technology and it is easier for them to get more qualified people. However, early adopters may have specific IS/IT competencies already developed that are not easy to copy, as occurred in *FIRM 1*.

### **6.7.2 – Determinant factors**

#### **d1) Development of IS/IT competencies: people and knowledge**

The firms in this study that were more successful with IS/IT adoption and use developed IS/IT knowledge in-house or have IS/IT knowledge available through associated IS/IT enterprises. IS/IT knowledge is used to develop, in-house or through an associated IS/IT enterprise, tailored manufacturing software that fits the production processes of the firm (*FIRMS 2, 3, 10, 11* and *12*), to negotiate with IS/IT suppliers the acquisition of IS/IT, and to co-operate in the development of software contracted out to software houses.

In *FIRM 2*, the CEO explains the importance of having IS/IT knowledge in-house.

*Since the beginning, 15 or 16 years ago, we hired an IS/IT person and we were lucky because the person we have here is a phenomenon in computer science. I leave IS/IT development with him, but I also get involved myself. This comes from an association between a person that is extremely capable (in IS/IT) and me, a person with experience of the business.* (Owner/entrepreneur of *FIRM 2*)



The firm also went a step further and the IS/IT expert and one of the two owners of the manufacturing firm created a software house. Therefore, they started selling software for the industry, developing IS/IT knowledge in-house and getting enough funding to cover IS/IT investments and research.

*FIRM 11* developed the integrated software in co-operation with an associated software house. The software house, which is owned by one of the sons of the CEO, was established with the aim of developing software for *FIRM 11*. The general manager of the software house explains that co-operation with the manufacturing firm is very important for them:

*...it is also important to know the industry and we get support from a footwear enterprise, FIRM 11, and an export firm...FIRM 11 is our example of success because they are using the whole software system. (General manager of the software house supplier of FIRM 11)*

*FIRM 1* built a small enterprise to test and apply new technologies, mainly IS/IT, into the organisation. The CEO states that the firm's ability to negotiate with IS/IT suppliers increased significantly due to the developed IS/IT competencies in-house:

*We started to deal better with that strange world, as equals, because people understood that we knew what we were looking for. We could do business with IS/IT suppliers, even about high technology. (CEO of FIRM 1)*

*FIRM 3* did not develop its IS/IT competencies in-house, it used an associated IS/IT firm. However, there is a complete engagement between this IS/IT firm and the manufacturing company. The firm used to be the major shareholder of the IS/IT supplier and strong links still exist between the top managers of the two firms. This allows the manufacturing firm to have access to good IS/IT support at a low cost. As the finance and IS/IT manager of *FIRM 3* explains, "since a significant part of the code is developed externally, we do not need to be at the edge of knowledge". Nevertheless, the firm has a computer centre with two people to manage the computer system and provide users support. The finance and IS/IT manager explains that although these firms are nowadays independent there still is a good relationship that goes far beyond a common business partnership. As the finance and IS/IT manager of *FIRM 3* states:

*We were on the 9<sup>th</sup> floor and the software house was on the 11<sup>th</sup> floor. We only needed to go upstairs, there was a family type of relationship... FIRM 3 sold its share in the software house but we are friends and the IS/IT services provided by the software house have been remarkable. (Finance & IS/IT manager of FIRM 3)*

*FIRM 12* developed IS/IT competencies in house, as the finance manager explains:

*It is an important factor for the success of IS/IT in this firm the fact that we have here all the people necessary to develop any software... most manufacturing SMEs do not have IS/IT professionals and then they have problems implementing IS/IT in their enterprises. (Finance manager of FIRM 12)*



*FIRMs 4, 5, 7, and 10 also have considerable IS/IT expertise although these firms nowadays do not develop their core software in-house.*

Since *FIRM 4* operates in the mould manufacturing industry, CAD/CAM systems for mould projects assume a critical relevance. Most CAD/CAM operators are qualified computer programmers. The CAD/CAM systems manager of *FIRM 4* explains this: *"the heart of the mould industry now is software programming. If the code is no good the machine does not work. Moulds are like software they are never OK the first time. This is a problem we feel, but people are used to it"*.

*FIRM 5* and *FIRM 7*, that operate respectively in the clothing and in the textile industries, are now involved in projects to install integrated management software systems. In *FIRM 5* although there is a computer centre, IS/IT experts are not comfortable with the new programming languages and development techniques. The new software was contracted out to a software house. However, the IS/IT professional of the manufacturing firm and the manufacturing manager (also the person responsible for IS/IT) work in collaboration with the software house and are fully committed and involved in the development of the new software. The manufacturing/IS/IT manager wants the IS/IT people to develop their knowledge about the new computer system:

*We want the IS/IT department to know how to make changes in this new application, they must learn the programming language, so that we will not depend on the IT supplier ... they must be able to make small changes and provide maintenance. (Manufacturing & IS/IT manager of FIRM 5)*

In *FIRMs 7* and *10*, although these firms have IS/IT knowledge (each firm has three IS/IT professionals), nowadays software is contracted out, essentially for economic reasons.

*All our needs were fulfilled by in-house IS/IT development. We always had in-house development... It would be nice to have more people in the IS/IT department. However, it could be expensive. We also hire the IS/IT services we need, hence we can be free to work on other things... (IS/IT expert of FIRM 7)*

*I believe that a firm that wants to develop software should get software developed externally but it must have at least one IS/IT person. The role of this person should be: contact with software houses, provide IS/IT training, and solve users' problems. A small firm that has only a computer, for accounting, it does not justify having an IS/IT person, but for medium-sized enterprises it is necessary. I would not say that it is indispensable but the ones that have a different opinion will find it difficult to succeed. (CEO of FIRM 10)*

It was found in the fieldwork that the firms that revealed lower levels of satisfaction with IS/IT adoption and use (*FIRMs 6, 8 and 9*) did not have much IS/IT knowledge to implement their systems. In *FIRM 9*, one of the largest firms in the study, it was clear that lack of expertise to select and adapt the software was one of the reasons why the adoption of the integrated software for administrative and manufacturing purposes has not



succeeded. Later, the firm hired one more IS/IT person and is now trying to solve the problem. The manufacturing manager recognises that it was a mistake not having an IS/IT person from the beginning, when the firm started implementing the integrated software system.

*We also made a mistake which was not having anyone in IS/IT. We did not have, from the beginning, an IS/IT person...MFG/PRO is, in my opinion, a very flexible package. Nevertheless, flexibility depends a lot on people. The package allows several levels of adaptations, different reports, but they must be programmed. They are not born there. (Manufacturing manager of FIRM 9)*

In FIRM 6 and FIRM 8, there is a person with some IS/IT expertise but in both firms this person does not work in IS/IT full-time. He only provides some users' support. In FIRM 6, one of the smaller firms in the study, the administrative manager (the senior manager that manages the firm in the absence of the CEO, who is in the firm only once a week) argues that she has lack of knowledge about IS/IT and that it is difficult to find advice about IS/IT matters.

*I confess, it is a pity I do not know much about IS/IT. There is lack of people in this area and they have different ideas, even the ones that know the subject. I haven't found consensus amongst them. I do not mean that we are in a bad situation but we are not where I would like to be. (Administrative manager of FIRM 6)*

In FIRM 8, the finance and IS/IT manager argues that "the firm needs an IT person". On the other side, the member of the staff that has some IS/IT expertise would like to develop the whole software of the firm: "I would like to work only in IS/IT, to have an office and develop IS/IT applications. ... In my opinion, we should have developed software in-house". However, this is viewed as a problem by the software house expert, arguing that because of his desire to develop the firm's software he is not committed to IS/IT implementation.

*The role of the IT person in FIRM 8 was not programming. However, his wish is to work only in software development.... He wanted to do everything. That was also a problem. (IS/IT vendor of FIRM 8)*

## d2) Top management support to the process of IS/IT adoption and use

In all the firms that displayed positive levels of satisfaction with IS/IT adoption and use, top managers were involved in the process. In many of these firms, the CEO/owner(s) had a crucial role in IS/IT development and acquisition (FIRMS 1, 2, 3, 4, 10, 12). In other firms, the *IS/IT project champion* was a senior manager very close to the CEO/owner(s), usually a member of the family, whom the CEO/owner trusts (FIRMS 5, 7 and 11). Some statements are presented as examples of top management attitudes found in the firms studied.



In *FIRM 2*, the IS/IT expert has experience developing software for the clothing and textile industry and he states that:

*The most important factor for IS/IT success in manufacturing SMEs is the capability of the owner...In this firm both owners are extremely open to IS/IT development. (IS/IT expert of FIRM 2)*

In *FIRM 1*, the whole board of directors was fully committed to implementing IS/IT in the firm. In order to acquire the first 3D CAD/CAM system all the three members of the board went on a trip around the world and analysed different systems in several countries to select the one they believed was best.

*For the success of this case, there is a thing I always believed in, which is the understanding and commitment of top managers. ... as a whole, we had an understanding of the problem and we believed on the solution we had. ... I knew a little bit more about information systems, technology and managerial techniques and they knew more about the mould industry and its market. (Former member of the board and IS/IT expert of FIRM 1)*

In *FIRM 10* the CEO explains that he fought against everyone to prove that the firm would be able to develop its own software systems.

*From the beginning we have an IS/IT person here. I hired a seamstress and I hired an IS/IT person. We have had IS/IT since the firm existed ...I fought against everyone, because everyone was telling me that I would not be able to make software, it would crash, there was not enough memory, etc ...It would have been easier for me to adopt an IBM 36 because the software was already developed for another firm where I worked, but I decided to start developing our own software and I do not regret... (entrepreneur/CEO of FIRM 10)*

In *FIRM 3*, the CEO also explains that commitment from the top is critical for IS/IT success:

*I do not believe in a project like this without complete involvement of the CEO. People start talking in the corridor, rumours, that the guy (CEO) said this, that he smiled about it, that he does not agree, and the people that are involved in the IS/IT project are completely crucified. It is necessary a complete engagement and involvement from the top down to the bottom. When people complain it is necessary to say: 'I already told you it must be done in this way, and that is all!'; 'do not tell me that!'; 'not today', etc. (CEO of FIRM 3)*

In the cases where there are lower levels of satisfaction with IS/IT (6, 8 and 9), the CEO is not involved in the process of IS/IT adoption. The *IS/IT project champion* is the finance manager and in none of these three firms was this person a relative of the owner(s). In *FIRM 8*, the finance manager is a young professional with low power in the organisation compared to other managers that have been longer in the firm and are relatives of the owners. In *FIRM 9*, the finance manager is also a professional manager and not a member of the board of directors, which is composed of the two owners of the enterprise and the



manufacturing manager. On the other hand, in *FIRM 9*, there were significant differences of opinion between the finance manager (also IS/IT manager) and the manufacturing manager about which software should be adopted by the organisation.

*The manufacturing manager is a member of the board of directors. He tells me to find someone to provide computer training but I keep tell him that I will not, because I do not agree with it. I think it is a mistake, they won't learn... It is the board saying one thing and me another. (Finance & IS/IT manager of FIRM 9)*

The CEO does not have IS/IT expertise and he does not get much involved in IS/IT decisions.

*I am the only person here that never started learning how to use computers because of lack of time and I need to be near someone when I want to use the computer. (CEO of FIRM 9)*

*FIRM 6* is a manufacturing enterprise owned by several co-operative associations of wine producers. The CEO is part-time in the firm and evidence was found of lack of leadership in IS/IT matters. The finance/administrative manager is the *IS/IT project champion* but she does not have IS/IT expertise nor power to impose IS/IT solutions in the manufacturing plant. Since the CEO is only present in the firm one day a week and there are many shareholders, the IS/IT supplier complains that decision making is slow. The board is very careful making IS/IT decisions, trying to avoid criticisms from the shareholders. On the other hand, there is a permanent conflict of perspectives between the finance and the manufacturing managers that inhibits IS/IT development. This conflict assumes greater relevance because the CEO is not directly involved in the process.

*The manufacturing manager and the administrative manager do not have a good relationship between them and that plays against us. In order to prejudice each other's interests, they may say that the computer system is not working well, and it affects us... I try to have a good relationship with everyone and sometimes I even have to try solving problems amongst people to avoid being affected by that situation. (IS/IT vendor of FIRM 6)*

Interestingly, *FIRM 8* and *FIRM 11*, although operating in the same industry and using similar software (developed by the same software house), have different levels of assessed IS/IT satisfaction. While the software works well in *FIRM 11*, it has been very difficult to implement and use it in *FIRM 8*. According to the software house expert, the main reason why it does not work well in *FIRM 8* is lack of top management support and involvement in the process of IS/IT adoption. Data collected in *FIRM 8* also confirm this.

*It was very difficult for me, mainly because I was also new in the FIRM. I was new and introducing new methods...The top managers (the owners of the firm), since they are elderly people, are not IS/IT users. They delegated that task to me and to the IS/IT person... Of course, they did not get personally involved. The top managers of this firm are receptive to new manufacturing technologies but not so much to IS/IT. (Finance manager of FIRM 8)*



*Owners have a passive attitude towards IS/IT adoption. Once in a while, they arrange a meeting, they ask how things are going on but I believe that it is not enough. Our software is working in a dozen other firms and hence it should work there too...It is also important to have motivation from the top to the bottom. When there is someone in the board of directors saying: 'No. This must be done through the use of IS/IT'. It makes things happen and reinforces the use of IS/IT by employees. (IS/IT supplier of FIRM 8)*

On the other hand, the general manager of *FIRM 11* also explains his role in the development of the integrated software system:

*We started to develop MSW (manufacturing software) from scratch, from making labels for shoe boxes to recording productivity levels, which is the critical part of this. (General manager of FIRM 11).*

In some of the cases where firms achieved positive levels of satisfaction with IS/IT adoption using software contracted out to a software house, managers were more interested in the quality and expertise of the people from the software house than in the quality of the software itself. This can be found in several statements, for example, in *FIRM 9* and *FIRM 10*. *FIRM 9* adopted successfully a previous administrative software, stopping using it later because it was decided by the board to implement a more powerful integrated software system. However, the firm experienced many problems with the implementation of the new software. The finance manager preferred the previous administrative software and, speaking about this system, he states that he always saw IS/IT support as important for the selection of IS/IT products and services.

*What I liked most was not the software itself, although the program was better and more flexible, based on the Database Management System Informix, but much more important, I found a group of people that knew what they were doing. (Finance and IS/IT manager of FIRM 9)*

The CEO of *FIRM 10* holds a similar opinion:

*In order to select IS/IT equipment we look at after-sale support and for quality in the team of the IS/IT supplier... it is basically the team and the support that are important for us to make our decision...We believed it was better to have as partners an excellent group of people, even with a product slightly inferior to the product of their competitors, than to have the best IS/IT product but with a worse team supporting it... (CEO of FIRM 10)*

### **6.7.3 - Consequent factors**

#### **c1) User attitudes**

The data collected suggests that user attitudes are a consequence of the involvement of top management in the process of IS/IT adoption. In *FIRM 9*, the manufacturing manager states that since employees know that the top management does not analyse the data on the computer they simply do not input it. In *FIRM 8*, the finance manager argues that manufacturing people do not use the computer system as they should because neither the



manufacturing manager nor the CEO put pressure on employees to start using the software. In *FIRM 6* interviewees declared that since the firm had had previous computer systems, users responded well to IS/IT adoption:

*I have never noticed any resistance of people related to IS/IT adoption. People even like to use IS/IT. (IT person of FIRM 6)*

*The firm had worked before with IS/IT and people did not have a problem adapting themselves to the new computer system. (IS/IT supplier of FIRM 6)*

In several other cases, resistance to change was solved by top management. Top managers provided IS/IT training and forced staff to do their tasks using IS/IT. Good examples can be found in case studies 1 and 3. In both these cases top management attitudes and the existence of IS/IT courses led to a better users' acceptance of the computer system. Evidence from this research supports previous findings that the effect of user attitudes in IS/IT success depends on top management support and involvement in the process of IS/IT adoption and on the level of IS/IT training.

## c2) Power relationships

Power conflicts may result from the adoption of IS/IT in the organisation. An environment of latent conflict may already exist, being activated by the introduction of IS/IT in the enterprise. Case studies 6 and 9 provide evidence of some of these conflicts. An interesting fact is that in the three firms that show lower levels of satisfaction with IS/IT adoption and use there was an eminent conflict of perspectives between the manufacturing manager and the finance manager as previously explained in *top management support to the process of IS/IT adoption and use (d2)*.

In *FIRM 8* the IS/IT supplier demonstrates that the implementation of IS/IT in the firm is perceived by employees as able to affect the balance of power in the organisation. People are afraid of losing their power, hence do not co-operate.

*In many factories people do not easily co-operate, they try to protect their own activity, making it secret. When an information system comes in, there is a revolution because it will affect privileges and information will be available for anyone. ...people are afraid of losing importance and prestige in the firm, and there are some negative reactions. FIRM 8 is a typical case where people do not co-operate, working together is extremely difficult. (IS/IT supplier of FIRM 8)*

Since in any of these cases the CEO was not much involved in IS/IT matters, these conflicts affected the process of IS/IT implementation. However, in the cases where the CEO was deeply involved in the process of IS/IT adoption and use, power conflicts and problems related to resistance to change were solved. Evidence suggests that the impact of power conflicts on the success of IS/IT adoption and use depends on top management



attitudes. If the CEO/owners are involved and leading the process of IS/IT adoption these conflicts are minimised or solved and do not affect significantly IS/IT adoption and use.

### c3) IS/IT vendors support

One advantage resulting from having IS/IT knowledge in-house is a better management of the relationships with IS/IT suppliers. If the CEO is involved in the process of IS/IT adoption and there is IS/IT knowledge available, IS/IT vendors' support is not perceived as a significant problem. If it becomes a problem the firm chooses another supplier and the existence of IS/IT knowledge in-house avoids a situation of dependency on the IS/IT supplier. Cases 5 and 10 provide examples of manufacturing firms that changed IS/IT suppliers because their performance was not satisfactory and the manufacturing firm was not deeply affected by that.

Case study 9 shows a situation of dependency from the supplier because the enterprise did not have IS/IT knowledge available to manage properly the process of IS/IT adoption. The manufacturing manager explains that: *"we had problems because the distribution of MFG/PRO in Portugal was given to a firm that was fighting to be responsible for technical assistance but they were not capable."*

In case studies 1 and 2, there is clear evidence that the development of IS/IT knowledge in-house increases firms' ability to deal with IS/IT suppliers and to get appropriate IS/IT support. Data suggests that the quality of IS/IT vendors' support depends on the development of in-house IS/IT competencies and top management commitment to the process of IS/IT adoption. These IS/IT competencies can be applied to select the vendor and evaluate its performance.

### c4) Business pressure to adopt IS/IT

An interesting symptom of IS/IT success is the pressure that some of the firms (*FIRMs 1* and *2*) put on their customers to use interorganisational information systems. It is not frequent in the literature to find cases where a relatively small supplier suggests the use of interorganisational systems. The usual situation is that large multinational customers put pressure on their suppliers to use EDI based systems (see for example Braganza, 1993; Iacovou *et al.*, 1996; Mukhopadhyay *et al.*, 1995). However, because *FIRM 1* and *FIRM 2* continuously search for new applications that can be used in the business, looking for external integration in order to face the increasing competition in the industry, these firms may be more innovative than their business partners. Therefore, they may have to suggest to them that they adopt new interorganisational information systems. This is the result of having IS/IT competencies in-house and a management perspective that the firm must search for innovative IS/IT solutions. The general manager of *FIRM 2* explains that:



*Customers do not put pressure on us to adopt new IS/IT, on the contrary, we put pressure on the customers to adopt IS/IT (laughing) ... we are trying that all our agents send us their orders by computer. (General manager of FIRM 2)*

*FIRM 1* has a very dynamic attitude towards IS/IT adoption and use. The CEO is extremely committed to the adoption of new technologies and the firm also puts pressure on customers to use their interorganisational information systems. The vice-president for operation explains the attitude of the firm in the adoption of new IS/IT:

*Sincerely, sometimes I think we are more innovators than large multinational enterprises. ... They see these technologies as interesting, they have it, but then they do not use it. (Vice-president of operations of FIRM 1).*

In some other firms ( *FIRMs 4, 6 and 10*), customers are the ones that suggest the use of interorganisational systems. In spite of that, none of these firms mentions any problems introducing interorganisational systems.

#### c5) IS/IT training (process)

IS/IT training takes place in most of the enterprises studied. In some cases, it occurs as a result of a management perspective that it is important to increase the ability of employees to use the computer system and their IS/IT knowledge. *FIRM 1* and *FIRM 10* are examples of enterprises where the owners place a great importance on IS/IT training to achieve IS/IT success. In *FIRM 1*, there is a training centre available and the CEO goes a step further by stating remarkably that he provides training for the whole local mould industry. This is because he believes that a lower performance of his local counterparts would have a negative effect on the image of the region as a mould supplier. In other cases, large IS/IT training projects occurred basically because there was EU funding available and firms decided to get benefits from that, as occurred, for example, in *FIRMs 3 and 8*.

#### c6) People involved in the process of IS/IT adoption

As was mentioned before, top management support and involvement in the process of IS/IT adoption plays a critical role in achieving IS/IT success. Having IS/IT knowledge in-house also implies that IS/IT experts from the firm will contribute to the development of computer systems in the organisation. Besides this, there is no evidence that the presence of IS/IT consultants or information systems analysts may lead to IS/IT success. Most manufacturing firms studied do not hire IS/IT consultants nor do the IS/IT experts of the firm use any formal information systems analysis and design techniques.

#### 6.7.4 – Not significant factors

##### n1) Consultant effectiveness

Only one of the firms involved in the study had proper IS/IT consultants (*FIRM 9*). However, this firm had many problems implementing the MFG/PRO software. Besides that, IS/IT suppliers also argue that they were doing “consultancy work” for their clients when implementing software (*FIRMS 8 and 9*). In another case (*FIRM 12*), the IS/IT manager was in fact an external consultant. This person was a former manager of the enterprise (hence a person with the trust of the board) and he still is in charge of the IS/IT department of the firm, which includes three IS/IT people.

It is also interesting to note that most managers do not see consultants as relevant for the process of IS/IT adoption. This occurs amongst some of the more successful firms. For example, in *FIRM 2*, the CEO states that: “*we never had consultants involved, we are the best consultants*”.

##### n2) Organisational structure

The position of the IS/IT manager in the organisational structure is pointed out in the literature as related to IS/IT success. However, many SMEs, including some of the ones studied, have an informal organisational structure, where the designation of the role may not clearly identify the power of the person in the organisation. In the firms that adopt and use IS/IT satisfactory or successfully (*clusters A, B and C*), the role of the IS/IT manager may not even exist (see *FIRM 11*). In *FIRM 12*, the IS/IT manager is formally an external consultant. In other cases the person in charge of IS/IT may be the finance manager (*FIRM 3*), a former finance manager (*FIRM 1*), the manufacturing manager (*FIRM 5*), or an IS/IT expert without significant managerial experience (*FIRMS 2, 7 or 10*).

##### n3) Formal evaluation of IS/IT benefits

In none of the cases studied was there any formal evaluation of IS/IT benefits. In fact, in all firms there were never defined specific objectives to be achieved by IS/IT, only vague targets. The lack of resources and expertise usually found in SMEs may explain why management processes are frequently informally conducted. Formal evaluation of IS/IT benefits does not seem to be a relevant factor for the study. One of the IS/IT professionals in *FIRM 9* explains the problem by mentioning that “*quantifying benefits is difficult. Some numbers are usually guessed when one thinks that something is good for the firm and should be quantified as an objective*”.



#### n4) Stages followed in IS/IT development

Some firms develop software in-house, others prefer to acquire software in the market and adapt it or contract software houses to develop specific software. Several firms that develop IS/IT knowledge in-house prefer to outsource most software development, allowing their IS/IT experts to undertake other tasks. These tasks may include user support, maintenance of previous software, selection of IS/IT suppliers, or identification of computer systems requirements. Examples can be found in *FIRMS 1, 3, 4, 7, 9 and 10*.

From the traditional models of software development, none of the firms studied did any IS/IT planning or careful cost/benefit evaluation. The use of formal systems analysis and design techniques is also almost non-existent. Most firms that develop software in-house use simple and informal approaches for systems analysis, writing most of the specifications of the system directly in computer code. From the data collected, there is no evidence that IS/IT planning or formal systems analysis, amongst other common stages followed in software development, are relevant in achieving IS/IT success.

#### n5) Frameworks and techniques used

As it was said before, software is frequently developed in an informal way. Moreover, most of the IS/IT experts interviewed were not familiar with formal techniques for IS/IT planning or systems analysis and design. In the firms studied, computer code was written using different programming languages, like 4 GLs, Visual Basic, C or RPG. From the data collected, there is no evidence that the use of a particular type of framework, technique or computer language may be related to IS/IT success.

### 6.8 – Analysis of the findings

#### 6.8.1 – Summary of cluster and factor analysis

Factors related to IS/IT adoption and success were evaluated individually and their interrelationships analysed. According to their perceived relevance, these factors were classified into four groups: *situational factors*, *determinant factors*, *consequent factors* and *not significant factors*.

*Situational factors* are factors that are important for IS/IT adoption and use but are not critical to achieving IS/IT success. These factors include several types of resources: financial resources, human resources, software available, IS/IT services and IS/IT external expertise available in the market. Some factors associated with *content* (type of IS/IT, IS/IT objectives, and time of IS/IT adoption) are also seen as *situational factors* because they influence the level of IS/IT success indirectly through the determinant factors.



*Determinant factors* are factors that essentially explain why some firms are more successful than others with IS/IT adoption and use. These include the development of IS/IT competencies, and top management perspectives and attitudes towards IS/IT adoption and use (more precisely, top management support and involvement in the process of IS/IT adoption and use).

*Consequent factors* are a ‘consequence’ of the *determinant factors*. Although *consequent factors* have an impact on IS/IT success, they are influenced by *determinant factors* and can be understood as the result of *determinant factors* in IS/IT success. For example, although IS/IT vendors’ support is relevant to IS/IT success, it was found that the quality of IS/IT vendors’ support depends on the development of in-house IS/IT competencies and top management attitudes. If a firm has IS/IT competencies it will be less dependent on IS/IT vendors. It will manage better its relationships with IS/IT suppliers and will force them to provide better services. Otherwise, top management will probably select another IS/IT supplier for its products or services, as occurred in *FIRM 5* and *FIRM 10*. *Consequent factors* include factors related to the *external context* (IS/IT vendors’ support and business pressure to adopt IS/IT), the *process* (people involved in IS/IT development, and IS/IT training) and the *internal context* (users’ attitudes and power conflicts).

Many of the factors pointed out in the literature as potentially able to influence the level of IS/IT satisfaction do not seem to be significant in explaining IS/IT adoption and success in Portuguese SMEs. These were classified as *not significant factors*.

Table 6.4 presents a summary of the cluster analysis and factor analysis, showing how each factor ‘behaves’ within a specific cluster and its relevance to determine the level of IS/IT satisfaction. The analysis of the data suggests that management perspectives and attitudes towards IS/IT adoption and the development of IS/IT competencies, in the firm or through an associated IS/IT enterprise, differ significantly between clusters A and D and have a strong role in explaining IS/IT success.

### **6.8.2 – Analysis of factor interrelationships**

Some of these factors also have internal links amongst them (see figure 6.4). There are two levels of interrelationships. In the first group, there are interrelationships between factors in the different categories (situational, determinant or consequence factors) that influence IS/IT success. In the second type, there are relationships between factors within the same category of influence in IS/IT success.

For example, the development of IS/IT competencies is influenced by the resources available, both in the internal context (financial situation of the firm and level of IS/IT education of employees) and in the external context (local IS/IT expertise and quality of the software available for industry).



As the analysis of the data from the case studies suggests, users' attitudes towards IS/IT use are likely to be influenced by the level of IS/IT training provided. *FIRMS 1* and *3* are good examples of how IS/IT training can increase the ability of employees to use computer systems and reduce users' resistance to change, providing a better usage of IS/IT in the organisation. Another example, clearly identified in this research and explained in *FIRMS 1* and *9*, is the fact that top management involvement in the process of IS/IT adoption and use also reduces employees' resistance to use IS/IT and potential power conflicts in the organisation.

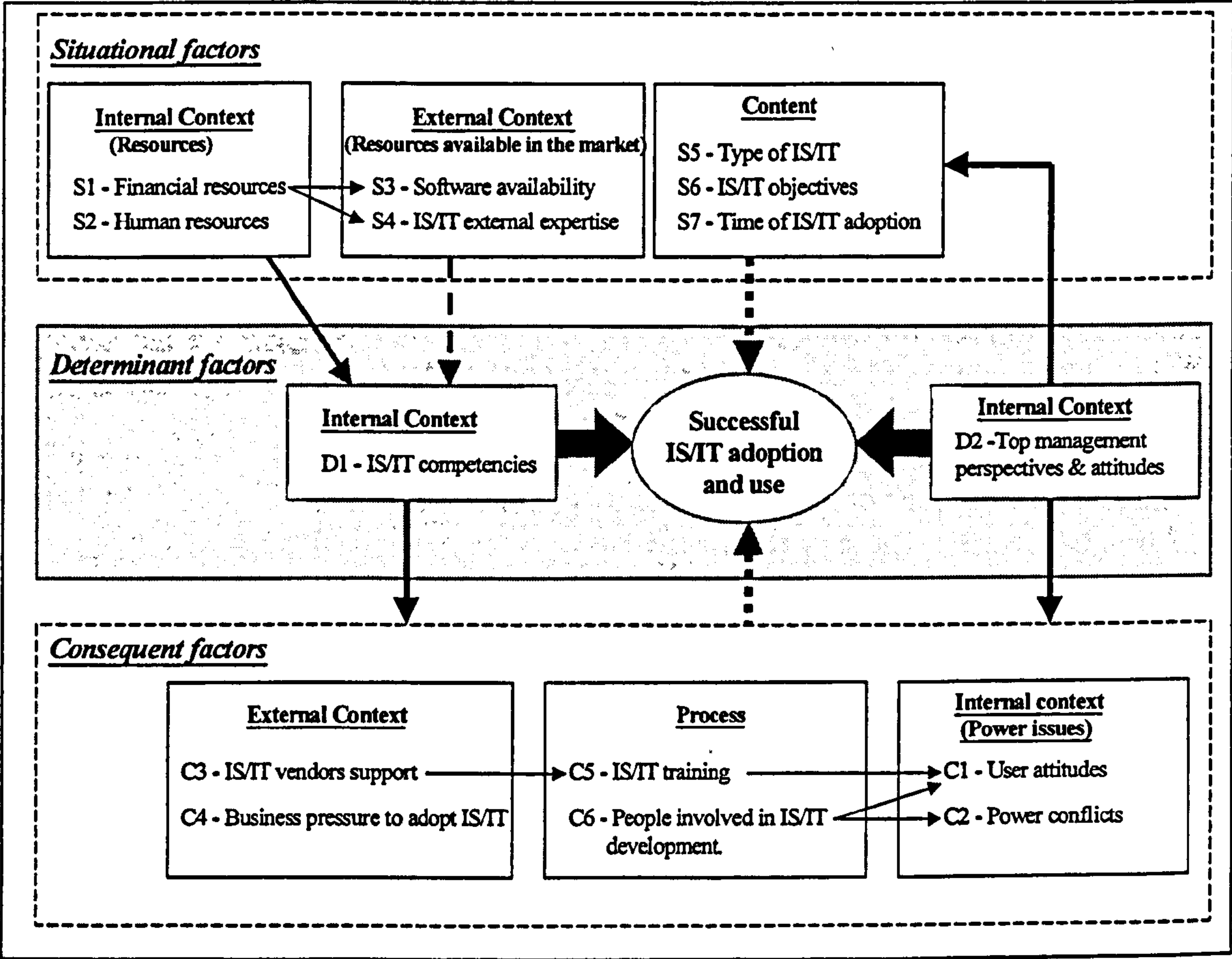


Figure 6.4 – Factors affecting IS/IT adoption and success  
 Source: Compiled by the author.

### 6.8.3 – Discussion of the determinant factors of IS/IT success

Higher levels of satisfaction with IS/IT adoption and use were achieved by the enterprises that were able to develop their IS/IT competencies. These competencies were used, not only to develop computer-based information systems in-house but also to contract out or acquire those systems in the market. In order to achieve IS/IT success, it is also important

to have the support and involvement of the top management during the process of IS/IT adoption. Empowering a senior manager for that role may also represent a workable alternative. Evidence was found that the combination of these two *determinant* factors, the development of IS/IT competencies and top management involvement towards the process of IS/IT adoption and use, was crucial to achieve high level of IS/IT adoption and success in Portuguese manufacturing SMEs.

The twelve cases studied covered a variety of scenarios that must be carefully analysed in order to understand how the *determinant* factors operate and interact. An analysis of the patterns of interactions between the key actors involved in the process of IS/IT adoption and use enables a better understanding of the assessed levels of IS/IT success. The analysis of these interactions helps to explain how IS/IT competencies were developed in the organisation and the role of top management in the process of developing those competencies.

It was noticed that firms in *cluster A* have very similar patterns of relationships between key actors. A similar situation was found in *cluster D*, where all firms also exhibit similar patterns. More significant differences can be found in the enterprises in the two other clusters - *B* and *C*.

#### **6.8.3.1 - Patterns of interactions between key actors in *cluster A* (see figures 6.5 and 6.6).**

In the firms that were more successful in adopting and using IS/IT (*FIRMS 1, 2 and 11*), a business partnership or strong personal relationships between top managers and a qualified IS/IT expert were identified. This enabled the development of IS/IT competencies in the enterprise and legitimacy to make IS/IT decisions. In *FIRM 1*, one of the senior managers was an IS/IT expert and later became a shareholder of the firm. In *FIRM 2*, one of the two owners/top managers and the IS/IT expert/manager of the firm became partners by setting up a new software house to develop the manufacturing software for the firm. This software house is also developing and selling proprietary software for other enterprises in the industry. In *FIRM 11*, the CEO is an elderly person who delegates IS/IT decisions to the general manager. However, the son of the CEO is one of the owners of both the hardware supplier and the software house that developed the integrated software system of the firm. A qualified IS/IT expert of the software house and the general manager of *FIRM 11* worked together in the analysis of the information requirements of the business, developing an integrated computer-based information system that meets the needs of the firm. This system was later sold to other enterprises in the same industry but, according to the IS/IT expert of the software house, it never worked as well as it does in *FIRM 11*.

In all firms in *cluster A*, top managers were supportive to IS/IT adoption and use and were involved in negotiating IS/IT products and services. They were also putting pressure on



employees to use IS/IT and were committed to solving problems of staff resistance to the use computer systems.

*FIRM 1* and *FIRM 2* developed strategic applications that enabled them to achieve competitive advantage. Both firms are performing well and, according to interviewees, are recognised as one of the best in their industries. *FIRM 11* only developed key operational systems, but with success.

Figure 6.5 shows the patterns of relationships between the key-actors involved in the process of IS/IT adoption and use in *cluster A*.

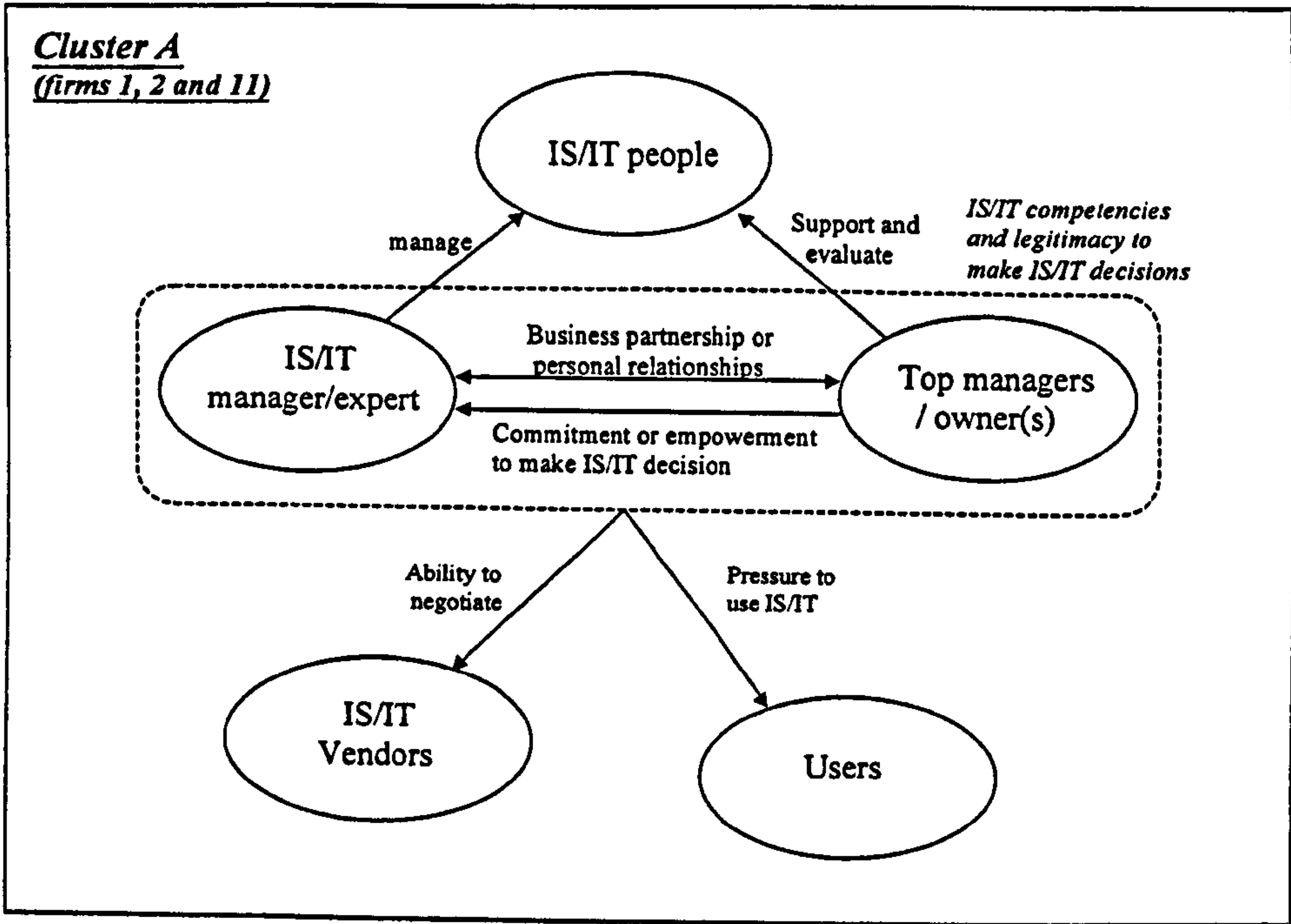
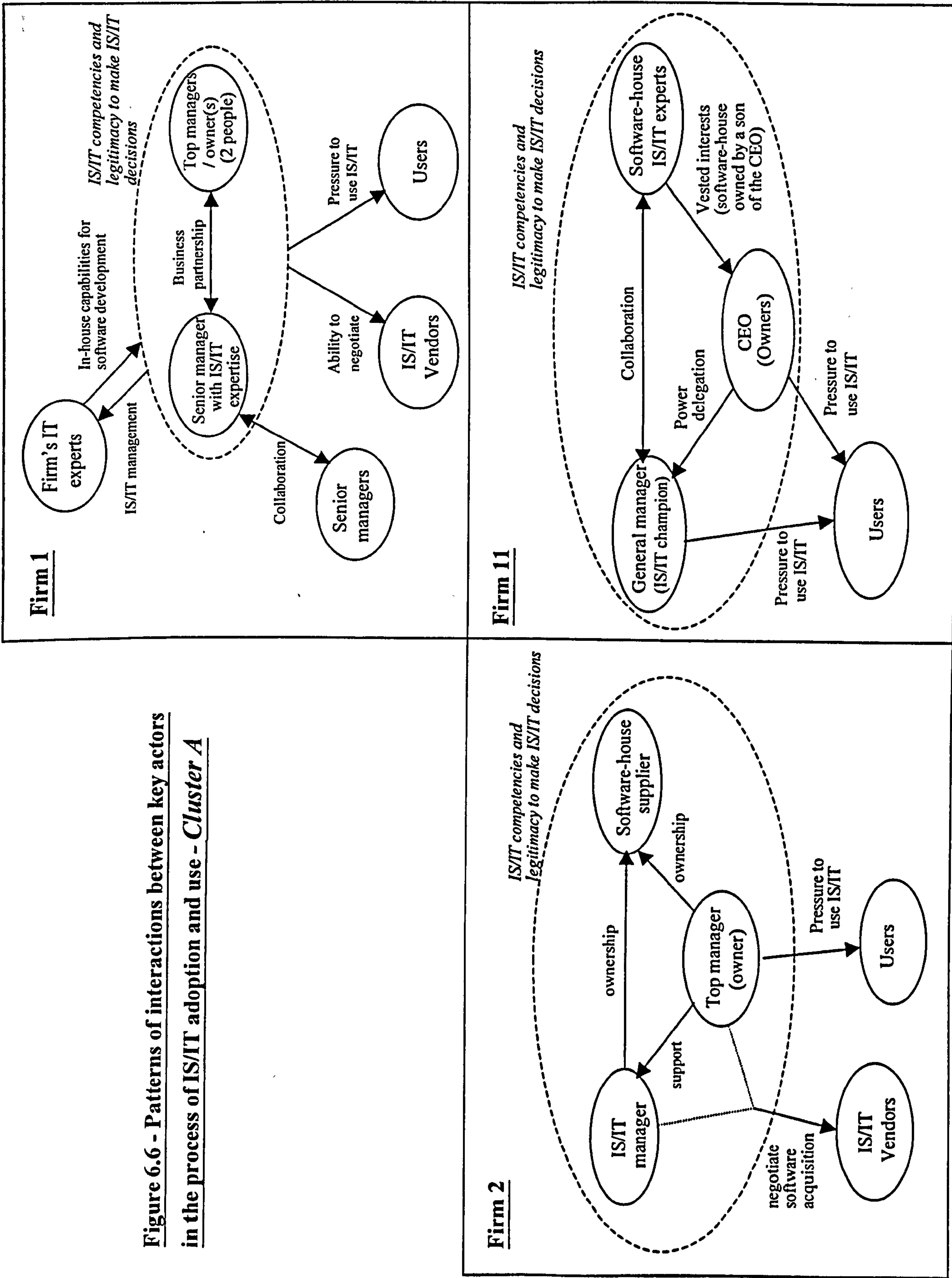


Figure 6.5 – Relationships between key actors in *cluster A*  
Source: Compiled by the author

**Figure 6.6 - Patterns of interactions between key actors in the process of IS/IT adoption and use - Cluster A**





### 6.8.3.2 - Patterns of interactions between key actors in *cluster D* (see figures 6.7 and 6.8).

By contrast, the firms in *cluster D*, that were “less than satisfied” or “unsuccessful” with IS/IT adoption and use, showed completely different patterns from the ones in *cluster A*.

In all these firms, the owners/top managers were not involved in the process of IS/IT adoption and use. The IS/IT project leader was the finance or administrative manager. Although the finance/administrative manager was the person responsible for IS/IT, none of them could be classified as an “IS/IT expert”. Moreover, none of these managers had enough power to impose their decisions about IS/IT adoption. As a matter of fact, none of them was a relative of the CEO/owner either, as was the case in some other firms in clusters *A* and *C* (*FIRMs* 5, 7, and 11).

In all the cases in *cluster D* evidence was found of conflicting views about IS/IT between the finance manager and the manufacturing manager. Employees also showed resistance to change and avoided the use of computer systems in their daily tasks. These problems were not solved because the individual responsible for IS/IT did not have the power in the organisation to lead the process of IS/IT adoption and top management was not involved.

The firms in *cluster D* did not develop internal IS/IT competencies. The technical support provided by IS/IT suppliers was also perceived as weak. However, some IS/IT suppliers complain that the person in charge of IS/IT did not have enough knowledge to define properly the information requirements of the enterprise (cases 6 and 9). The selection of the IS/IT suppliers was also a difficult process due to lack of IS/IT knowledge in the organisation (see for example case 9).

The firms in *cluster D* were outsourcing or buying in their core manufacturing applications. However, the findings do not suggest that IS/IT success is linked to in-house software development. It was found that many managers in the firms that were satisfied with IS/IT adoption and use would like to outsource IS/IT development, and some did so. The firms that were less successful with IS/IT adoption and use were buying in the market or contracting out their core software applications because, since they did not have sufficient IS/IT knowledge, they could not develop this software in-house. This strategy of contracting out IS/IT development is a consequence of lack of IS/IT competencies and the analysis of the data does not suggest that *insourcing* IS/IT development is a necessary condition for IS/IT success.

Figure 6.8 summarises the identified patterns of interactions between key-actors in *cluster D*.

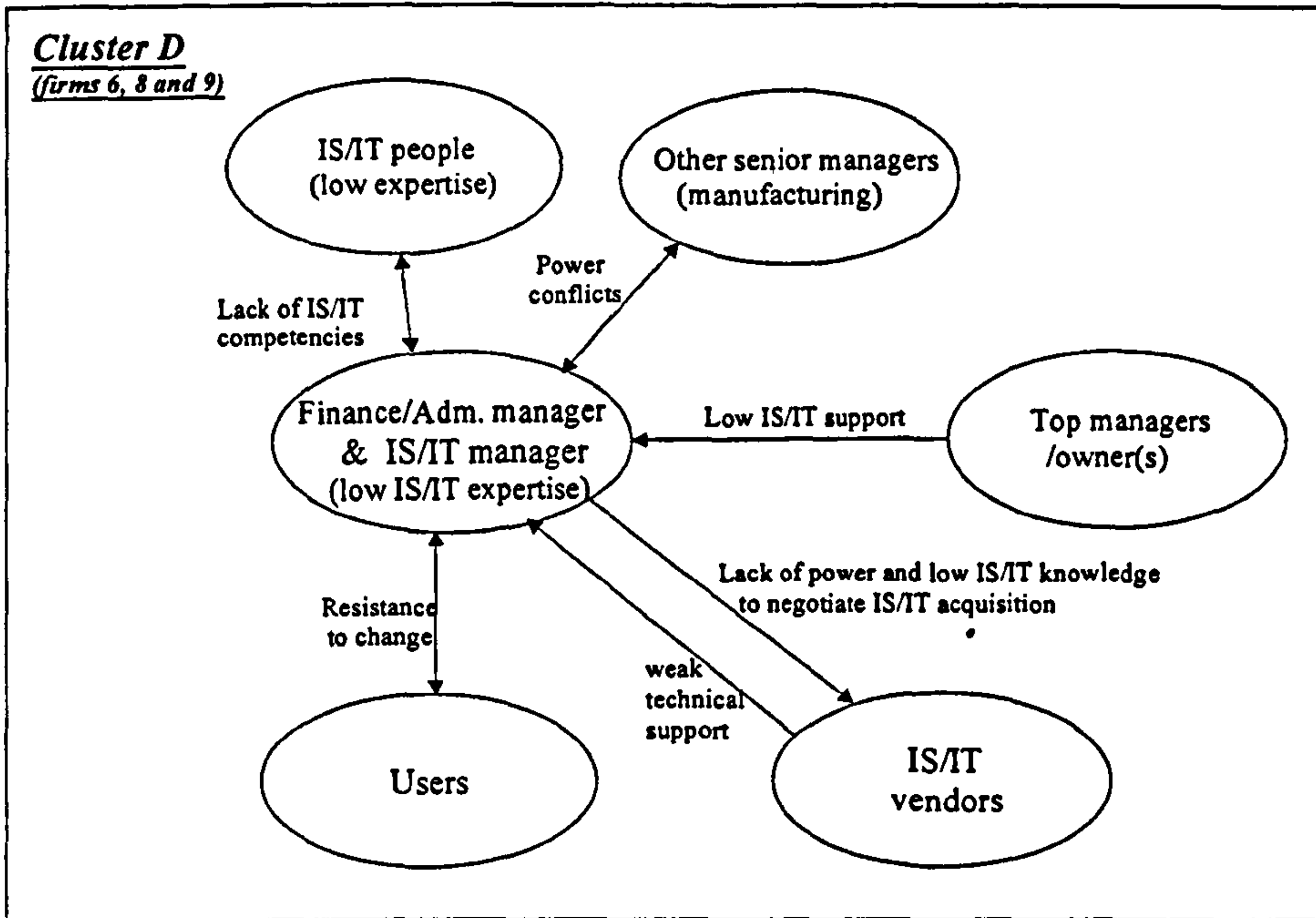
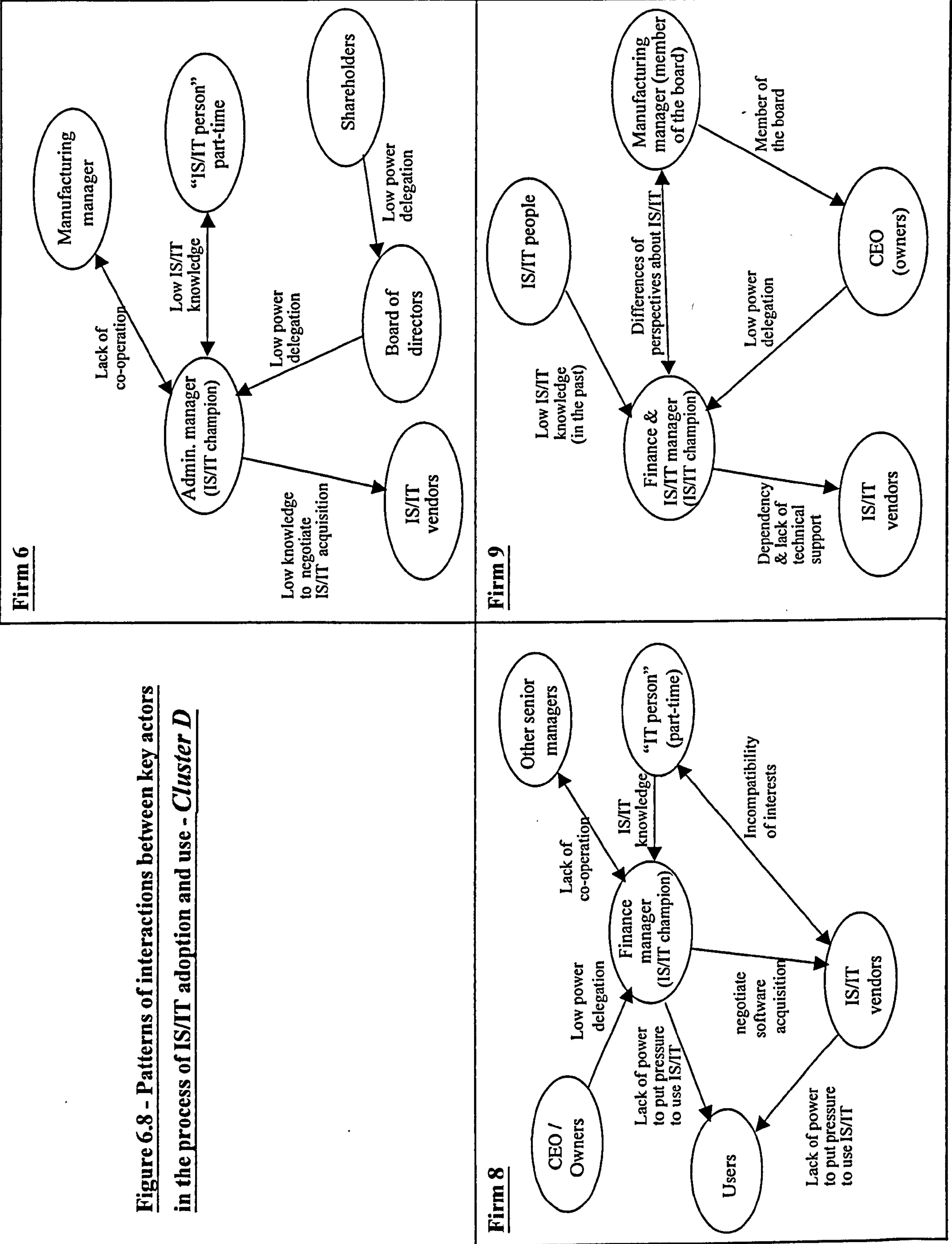


Figure 6.7 – Relationships between key actors in *cluster D*  
Source: Compiled by the author



**Figure 6.8 - Patterns of interactions between key actors in the process of IS/IT adoption and use - *Cluster D***



### 6.8.3.3 - Patterns of interactions between key actors in *cluster B* (figures 6.9 and 6.10)

Since the firms in *cluster B* achieved positive levels of IS/IT satisfaction, the patterns found in *cluster B* are more close to the ones identified in *cluster A*.

The firms in *cluster B* developed their integrated software several years ago, in the late 1980's. Although both firms have an IS/IT department, the major role of this IS/IT department is the maintenance of the existing computer-based information systems. These firms do not search for innovative ways of applying IS/IT in their business. In *FIRM 12*, computer systems were developed in-house, while in *FIRM 3* the software was developed by a partner software house that previously belonged to *FIRM 3*. In both firms, evidence was found of top management support to the process of IS/IT adoption and use. However, in *FIRM 12* top managers delegated IS/IT decision making to an IS/IT consultant that was a previous senior manager of the firm.

Unlike *FIRMS 1* and *2* in *cluster A*, the firms in *cluster B* did not look for strategic applications and top managers were less involved in the process of IS/IT adoption. For example, in both *FIRM 1* and *FIRM 2* the top managers were leading the process of IS/IT adoption, participating in hardware and software selection. In *FIRM 3* and *FIRM 12*, top managers, although supporting the process of IS/IT adoption, delegated the leadership of this process to the IS/IT managers, but they were committed to solve the problems of resistance to change that occurred in these firms. Figure 6.10 shows the major patterns of firms in *cluster B*.

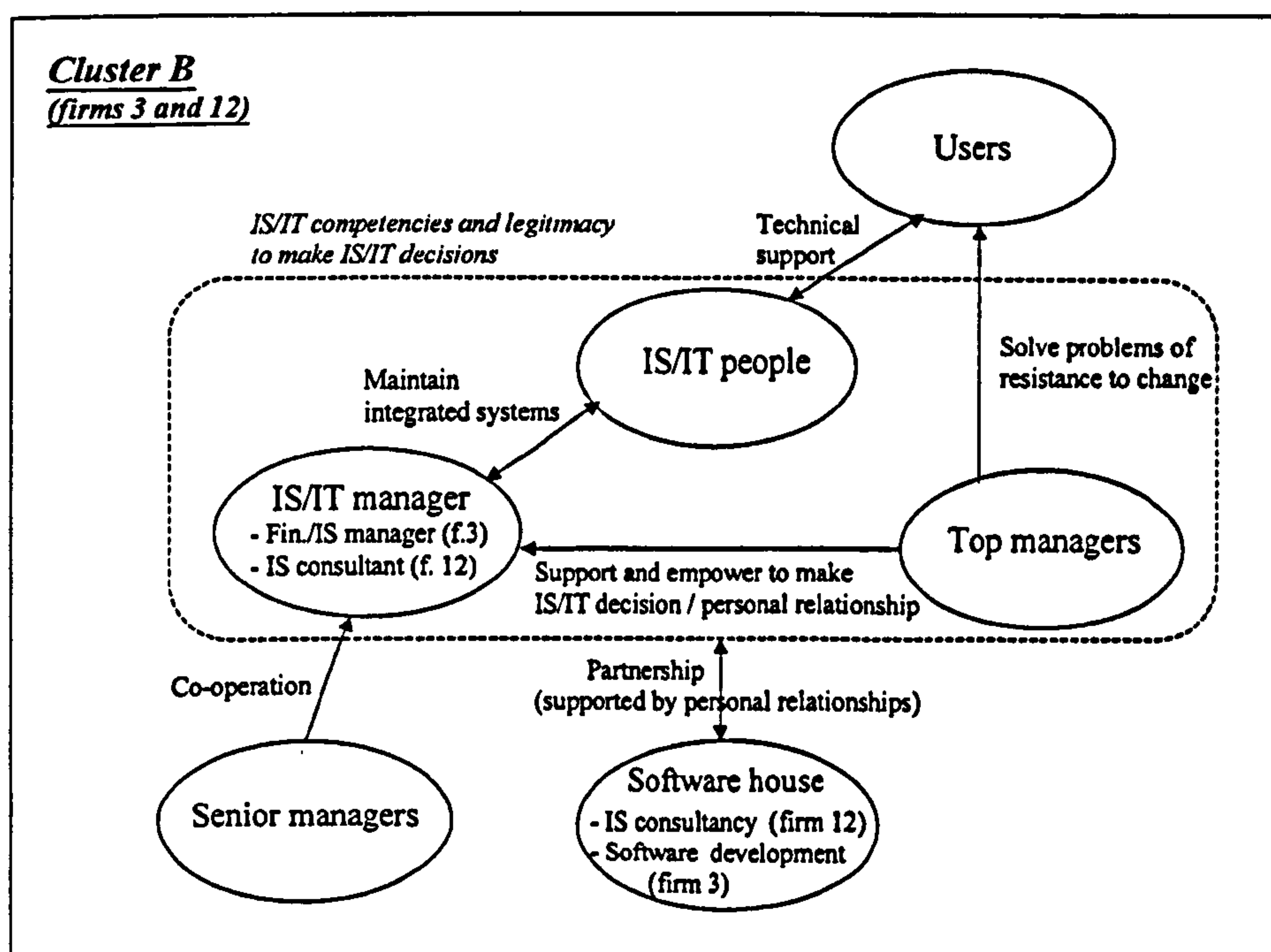
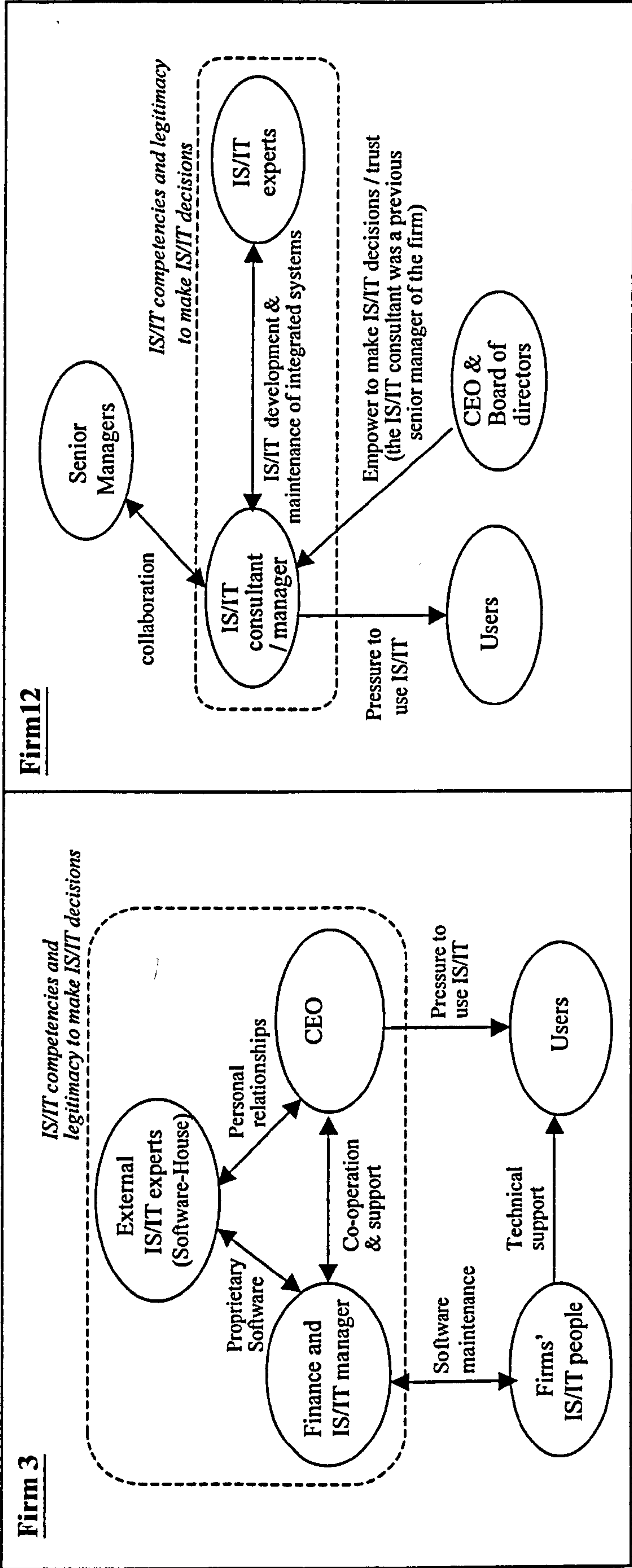


Figure 6.9 – Relationships between key actors in *cluster D*  
Source: Compiled by the author



Figure 6.10 - Patterns of interactions between key actors in the process of IS/IT adoption and use - *Cluster B*



#### 6.8.3.4 - Patterns of interactions between key actors in *cluster C* (figures 6.11 and 6.12)

Like the ones in clusters *A* and *B*, firms in *cluster C* also developed IS/IT competencies in-house. However, the most important software of these firms was not developed in-house, it was contracted out or bought in the market. IS/IT competencies were basically used to select, install and maintain that software. Nevertheless, management carefully followed the process of IS/IT adoption and use.

Top managers empowered a senior manager to make IS/IT decisions, except in *FIRM 10*, where the CEO, himself, was leading the process of IS/IT adoption. In *FIRM 4*, the person responsible for IS/IT was an IS/IT expert/manager, while in *FIRMS 5* and *7*, IS/IT was the responsibility of a senior manager, who was also a relative of the CEO/owner. In all these firms, the IS/IT manager, because of capital ownership or top management trust, had power to develop IS/IT in the organisation. On the other hand, there was IS/IT knowledge available in the firm. All the firms in this cluster had at least two IS/IT professionals besides the member of the staff responsible for IS/IT.

Figure 6.12 gives a global perspective of the patterns of relationships between key actors in the firms in *cluster C*. Some similarities can be found between the patterns in *cluster C* and the ones shown in clusters *A* and *B*, but there are significant differences between the firms in clusters *A*, *B* and *C*, and the ones in *cluster D*.

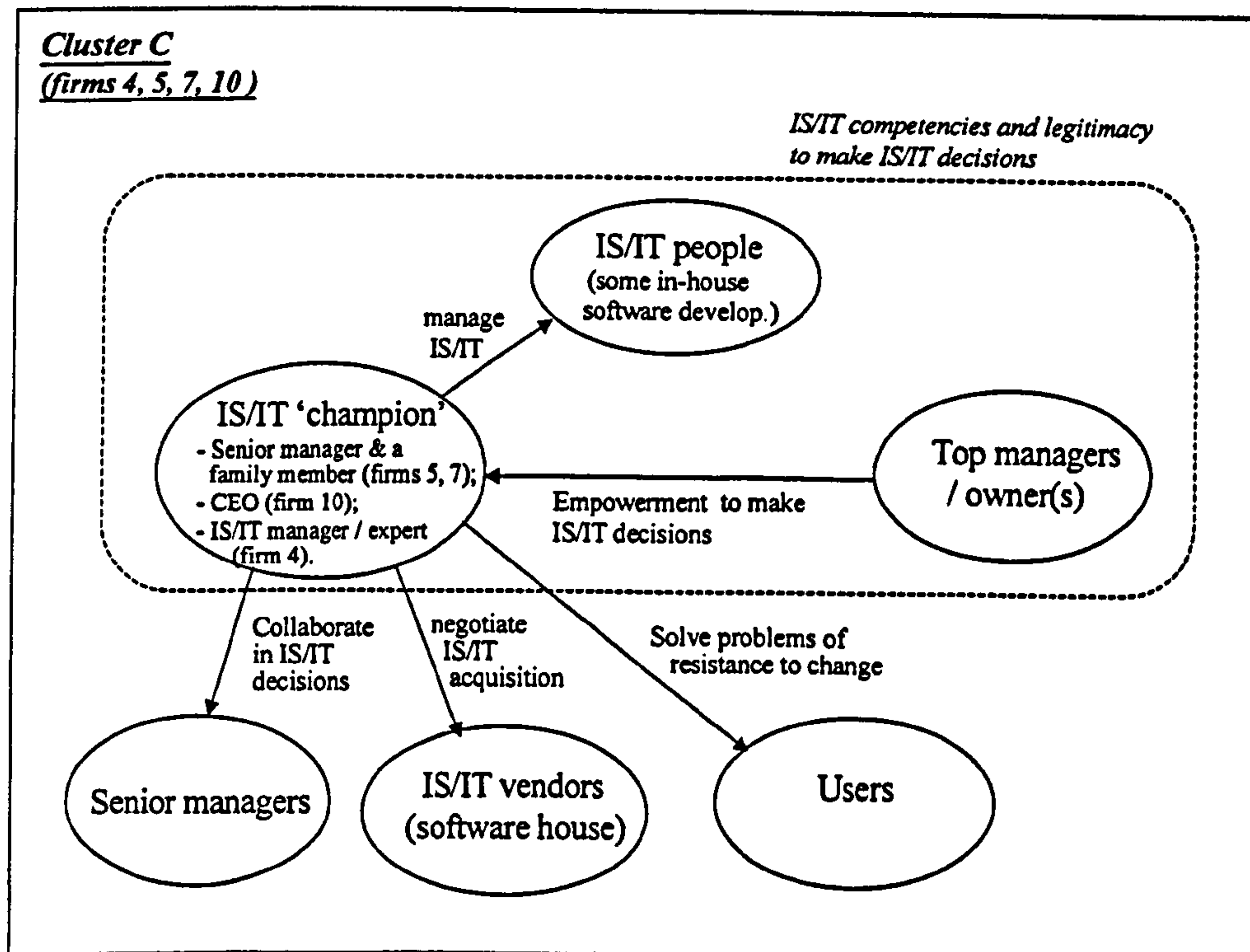
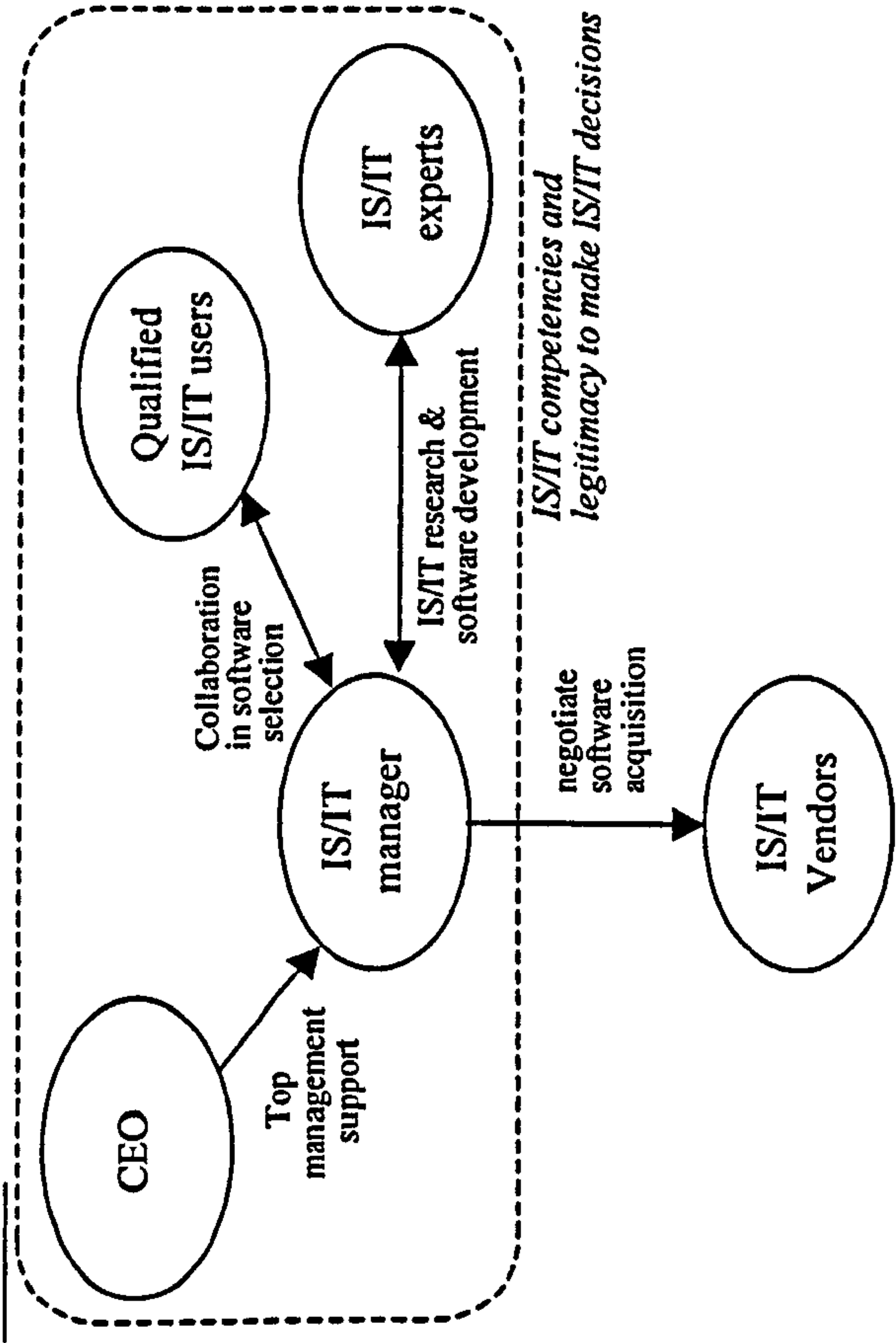


Figure 6.11 – Relationships between key actors in *Cluster C*  
Source: Compiled by the author

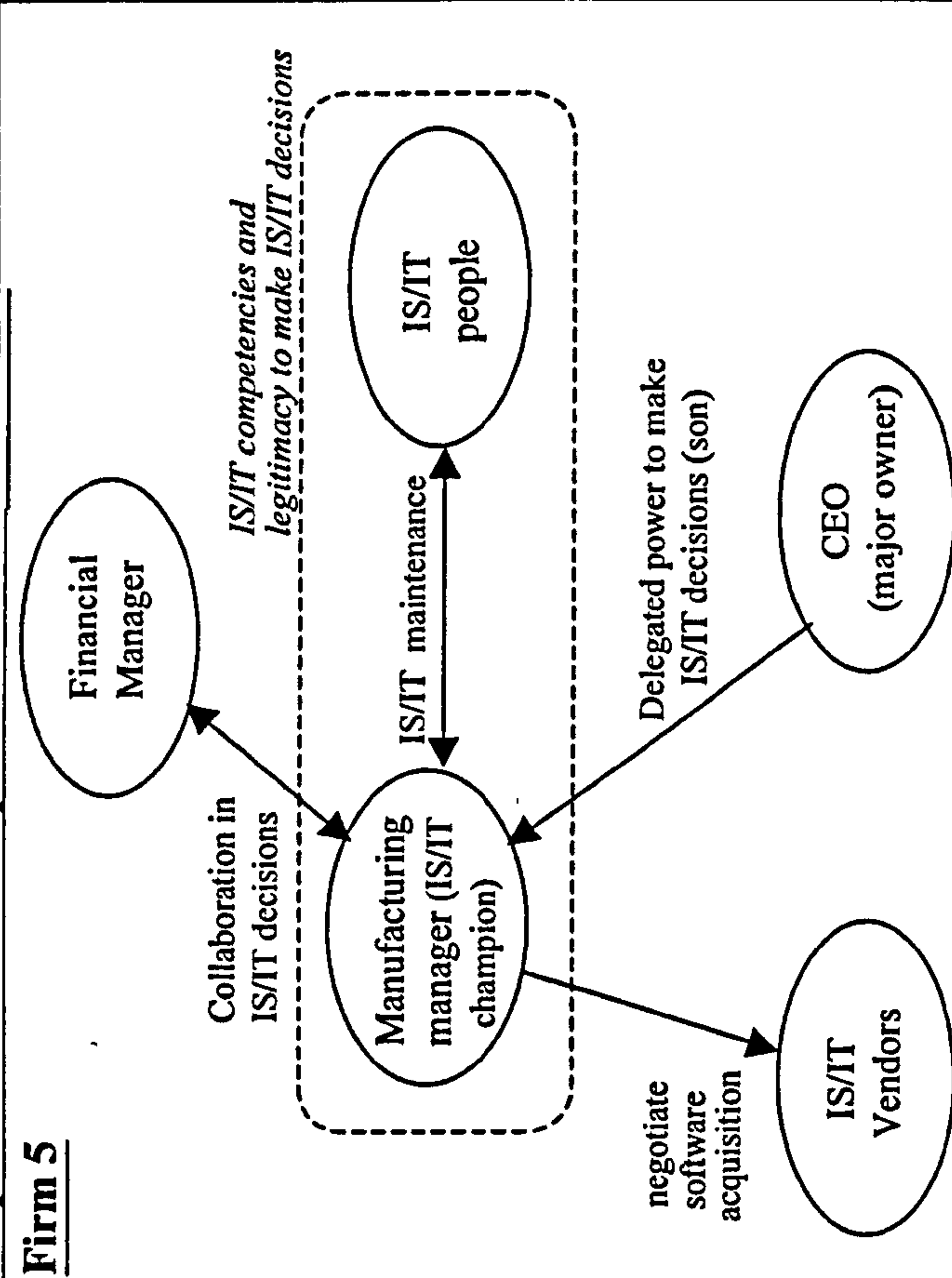


Figure 6.12 - Patterns of interactions between key actors in the process of IS/IT adoption and use - Cluster C

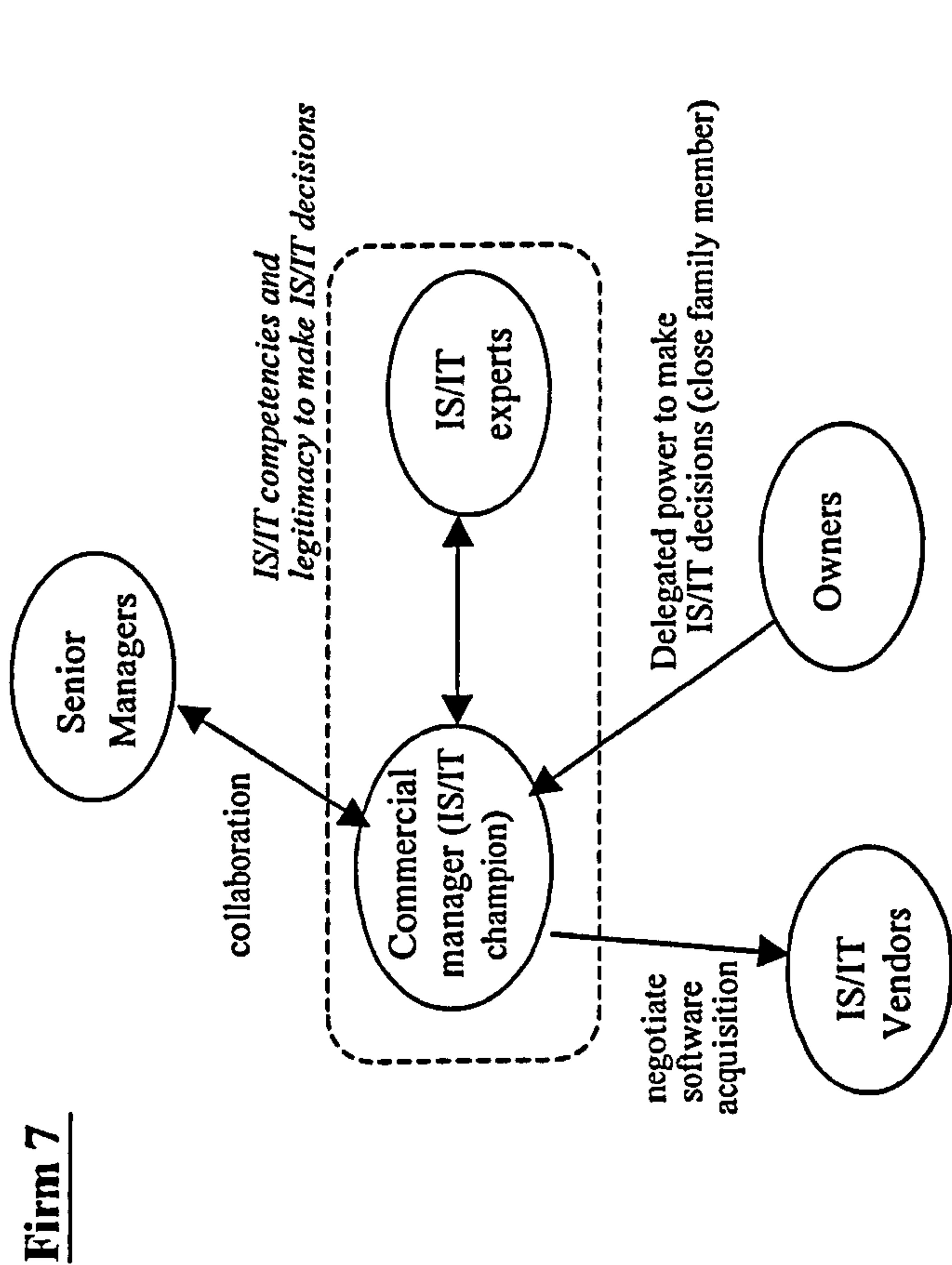
Firm 4



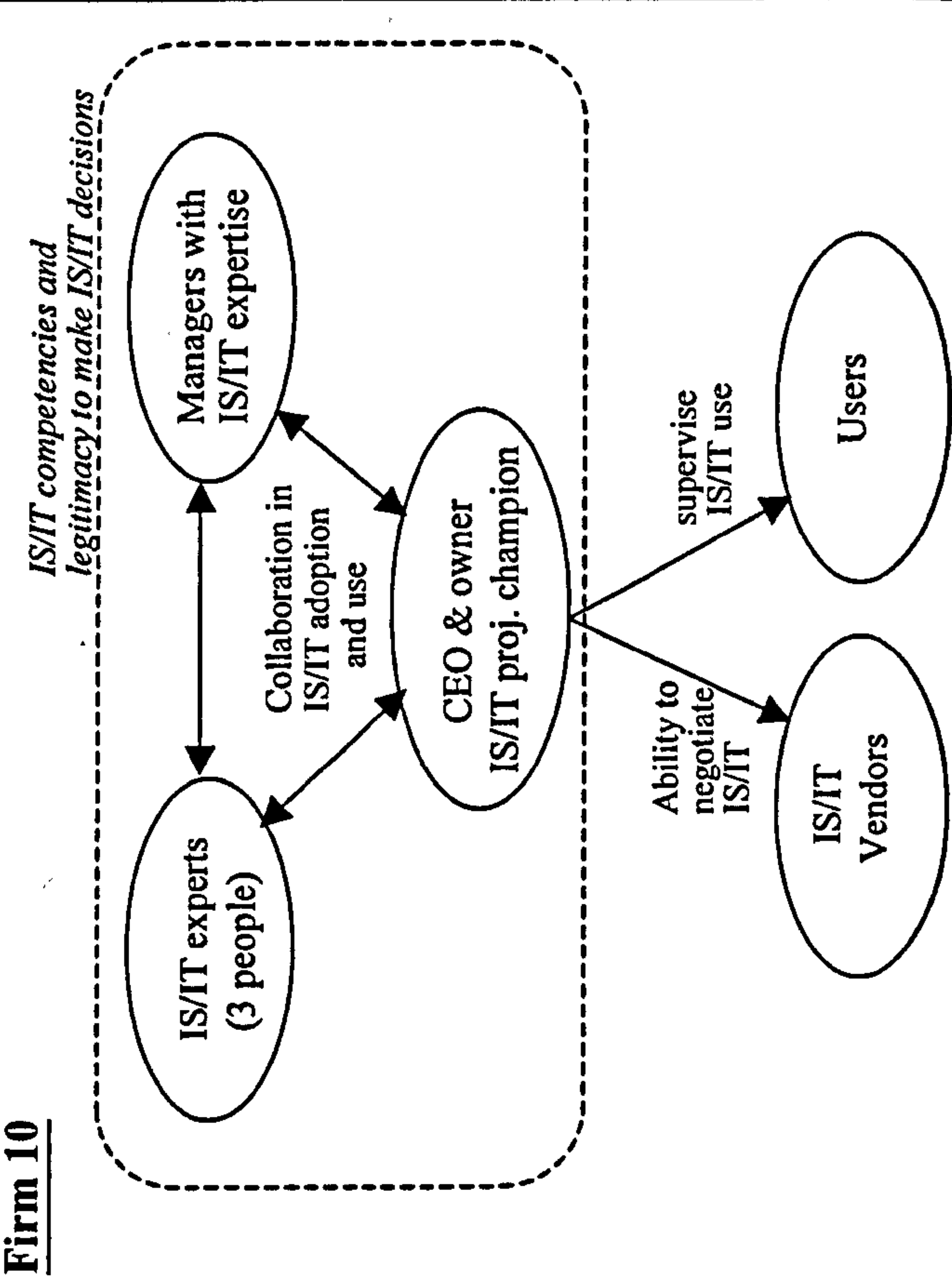
Firm 5



Firm 7



Firm 10



**6.8.3.5 – Patterns related to top management commitment and the level of IS/IT adoption**

Figure 6.13 illustrates the relationship between the position of the *IS/IT project champion* in the organisation structure, the type of IS/IT adoption (software development in-house or software acquisition), and the assessed level of IS/IT success.

The involvement of top management in the process of IS/IT adoption and use, leading this process (*IS/IT project champion*), was important to achieve positive assessed levels of IS/IT adoption and success. Examples can be found in *FIRMs 1, 2, 3 and 10*. In other cases, where the CEO/owner although interested and supporting IS/IT adoption is an elderly person or someone without any IS/IT knowledge, a senior manager of the firm was deeply involved in the process of IS/IT development. In *FIRMs 5, 7 and 11*, this senior manager is a younger family member with power to make IS/IT decisions. In *FIRMs 4 and 12* it was the IS/IT expert/manager, a person holding the CEO’s trust. In the firms that achieved lower levels of IS/IT success, IS/IT competencies were not developed in-house, software was contracted out or bought in the market. The person responsible for IS/IT in the organisation was a functional manager with low IS/IT knowledge and lack of power to make IS/IT decisions, as was the case in *FIRMs 6, 8 and 9* (see figure 6.9).

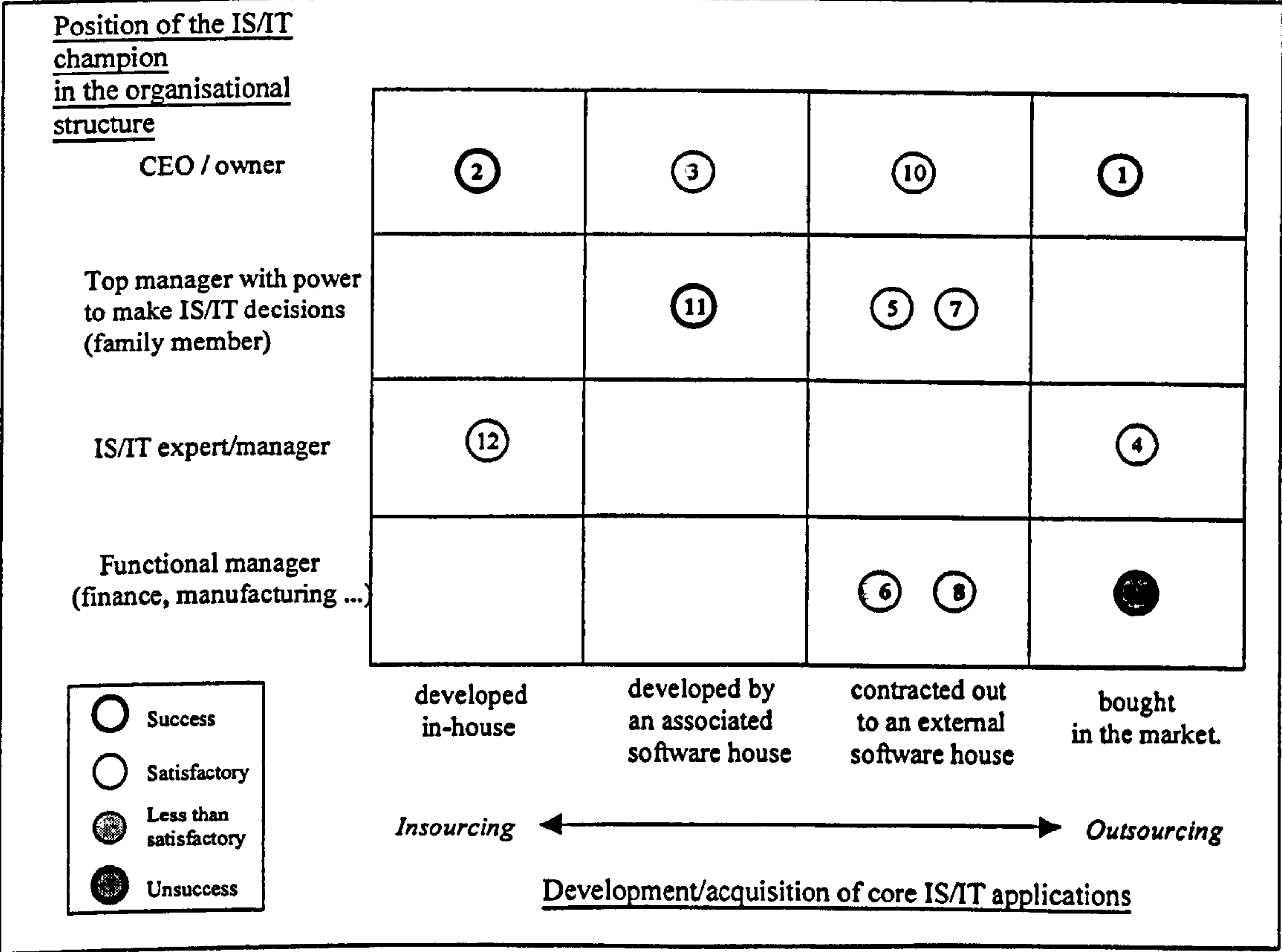


Figure 6.13 – The influence of management involvement in IS/IT adoption and success.  
 Source: Compiled by the author.



#### **6.8.4 – Discussion of the findings in relation to the initial research propositions**

In chapter 3 several propositions were presented for consideration and study via the cases. These propositions are discussed in this section based on the analysis of the data gathered in the case studies.

*a) CEO's support, although important to IS/IT adoption and use, does not necessarily lead to IS/IT success if the firm has low IS/IT expertise (internal and external).*

From the analysis of the case studies it was found that CEO support and involvement in the process of IS/IT adoption and use and the development of IS/IT expertise, in-house or in an associated IS/IT firm, are important factors for IS/IT success. In the firms that showed higher levels of assessed IS/IT satisfaction (*FIRMS 1, 2 and 11*), the availability of IS/IT competencies was essential to achieve IS/IT success.

In *FIRM 5*, a firm with satisfactory levels of IS/IT adoption and use, modern software has been developed by an external software house. *FIRM 5* had some problems with IS/IT in the past and top managers stated that they were 'lucky' finding the actual IS/IT supplier.

High levels of IS/IT satisfaction are related to a complex set of combinations of relationships amongst factors related to CEO support and involvement in the process of IS/IT adoption and use and the development of IS/IT expertise, in-house or in an associated IS/IT firm.

*b) The successful adoption of IS/IT in manufacturing SMEs is related to the presence of a person that has IS/IT knowledge, CEO trust and a perspective of IS/IT use according to the business strategic orientation of the firm.*

In some of the cases studied although the CEO was interested in IS/IT development he did not have IS/IT management knowledge and experience to conduct the process of IS/IT adoption. In the firms that show positive levels of satisfaction with IS/IT, it was important to have the involvement of a person that had some IS/IT management knowledge to manage the process of IS/IT adoption. Furthermore, evidence from the major case studies suggests that this person must have a clear perspective of the strategic impact of IS/IT in the firm and the CEO's trust.

In *FIRMS 5 and 7*, the *IS/IT project leader* was the manufacturing manager of the firm. In both cases, this person was a close family member of the CEO/owner holding a University degree. In *FIRM 1*, the *IS/IT project leader* was an experienced top manager and shareholder of the firm, who was also a lecturer in the field of information systems (although, in this case, the CEO was also deeply involved in the process of IS/IT adoption). In *FIRM 4*, the *IS/IT project leader* was the CAD/CAM systems manager, a



professional IS/IT manager, whom the CEO trusted. In *FIRM 12*, it was the external IS/IT consultant/manager, a former senior manager of the firm, well known by the owners. In *FIRM 2*, the IS/IT expert/manager and one of the owners (and top manager) own a software house and were partners in software development for the enterprise and for the industry. Top managers in *FIRMS 3* and *11* had strong personal links with their IS/IT suppliers, as previously discussed. In both cases, the CEO (*FIRM 3*) and the general manager (*FIRM 11*) were deeply involved in the process of IS/IT adoption and use. In *FIRM 10*, the CEO had some IS/IT management expertise and was, himself, leading the process of IS/IT development in the organisation.

In the cases that were less successful, adopting and using IS/IT (*FIRMS 6, 8* and *9*), the *IS/IT project leader* did not have either the knowledge or the power to manage the process of IS/IT adoption. In any of these enterprises, the CEO was deeply involved in the process of IS/IT adoption and use. Empirical evidence shows that situations of conflict between top managers occurred due to lack of leadership in the IS/IT adoption process.

*c) Although most firms have low IS/IT expertise, consultants are not seen by CEOs as necessary in the process of IS/IT development. External IS/IT consultancy in manufacturing SMEs is not perceived as good. On the other hand, manufacturing SMEs do not seem attractive for experienced IS/IT consultants.*

Almost all firms studied did not consider the use of external IS/IT consultants. This may be due to the lack of quality of IS/IT consultancy available (as reported by several interviewees), lack of top management trust in external IS/IT consultants, or managers' belief that developing their own IS/IT competencies is the best way to achieve IS/IT success (as stated by top managers in *FIRMS 1* and *2*, two of the most successful firms). The few enterprises that used some external IS/IT expertise have a special relationship with the external IS/IT experts/consultants, whom they have known for a long time (examples can be found in *FIRM 11* and *FIRM 12*).

*d) IS/IT failure is usually perceived by managers as mainly related to the low quality of software available and low vendors' performance. Many firms do not realise the need to develop their IS/IT competencies.*

Several interviewees claimed that the manufacturing software available in the market does not fill their needs and the firms that achieved higher levels of satisfaction with IS/IT adoption and use developed their own IS/IT competencies. Consequently, they were not depending entirely on IS/IT vendors. In *FIRM 6* (a firm where IS/IT adoption was evaluated as 'less than satisfactory'), the administrative manager (also responsible for IS/IT) complained that the software available in the market does not fit their requirements: Furthermore, she states that IS/IT vendors' support has not always been



good. In *FIRM 9*, poor IS/IT vendors' support was referred to as one of the main reasons why the implementation of the integrated software system failed. However, these firms did not develop internal IS/IT competencies.

*e) Lack of good software available for production management seems to be a problem for the firms in the industry. These SMEs have problems in adapting the existing software to the specifications of the industry because they have low IS/IT expertise and lack of bargaining power with software houses.*

Several interviewees stated that the development of IS/IT knowledge increases the capability of the firm to construct its own software applications and negotiate IS/IT acquisition with IS/IT suppliers. The administrative software available was generally reported as good and easy to adapt to the requirements of the firm. On the other side, it was confirmed in the research that manufacturing software is critical for the SMEs studied. Some of the firms analysed did not have enough expertise to adapt this software to the requirements of the firm and evidence suggests that this was one of the reasons why they did not achieve higher levels of IS/IT satisfaction.

*f) Lack of systems integration is a common problem in SMEs and reflects their lack of IS/IT competencies.*

Lack of systems integration was, in fact, a problem for several firms studied, with particular relevance in *FIRMs 8* and *9*. Neither of these firms had significant IS/IT expertise in-house. The integrated software systems available were developed by the IS/IT department of the enterprise (*FIRMs 2* and *12*) or by an associated IS/IT firm (*FIRMs 3* and *11*).

The firms operating in the mould industry (*FIRMs 1* and *4*) strongly depend on CAD/CAM software. Due to its complexity, this software must be acquired in the market. Since a mould is a unique product, with specific requirements that are difficult to standardise, other manufacturing software (like MRP) is less useful and not as easy to implement in these enterprises.

*g) Although manufacturing SMEs traditionally lack financial resources, IS/IT costs are not seen as a major inhibitor to IS/IT development.*

IS/IT costs were not seen as a significant inhibitor to IS/IT development for most of the firms. Only in *FIRM 8* some concern about IS/IT costs was reported. In *FIRM 12*, managers also reported that in the recent past, because the financial situation of the firm was not good, they did not invest in IS/IT. None of the firms that present higher assessed levels of IS/IT satisfaction (*FIRMs 1*, *2* and *11*) nor the firm where IS/IT development was unsuccessful (*FIRM 9*) showed any concern about IS/IT costs. This



confirms the evidence gathered in the initial fieldwork that IS/IT costs are not a major constraint to IS/IT investments. As many top managers say, they are willing to invest in IS/IT if they think that it will yield benefits.

*h) Because SMEs have low IS/IT knowledge, the benefits that CEOs expect from the use of IS/IT vary considerably across firms, essentially according to personal beliefs. Most CEOs' perceptions of IS/IT benefits are unrealistic or, on the contrary, underestimate IS/IT use. Satisfaction with the existing systems seems significantly constrained by the expectations and beliefs about IS/IT benefits.*

Contrary to the firms analysed in the initial fieldwork, most enterprises studied in the case study research phase were firms that manifested positive levels of satisfaction with IS/IT adoption and use. In these firms no evidence was found that CEO's perception of IS/IT benefits were unrealistic nor do they underestimate IS/IT use. However, in some of the cases that presented lower levels of IS/IT satisfaction (*FIRMS 8 and 9*), evidence was found that top managers underestimated the complexity of the process of IS/IT adoption.

*i) Internal conflicts related to power changing hands as a consequence of IS/IT implementation and development tend to be perceived by large enterprises but not by SMEs in manufacturing industries. SMEs have a more simple and flat organisational structure with a dominant role of the CEO/owner and a family type relationship between managers. IS/IT development is not perceived as able to produce a significant change in the way power is distributed.*

IS/IT development is not perceived as producing a significant change in the way power is distributed. In the three firms that were less successful with IS/IT adoption, conflicts between managers, related to IS/IT adoption, were found. As it was pointed out before, empirical evidence suggests that these conflicts occur because of lack of CEO's/owners commitment and leadership. When the CEO/owner was involved in the process of IS/IT adoption, potential power conflicts associated with IS/IT were solved. This is consistent with the literature (previously discussed in chapter 2) that stresses the dominant role of the CEO in SMEs, being able to stop any significant power conflict within the organisation. In some other cases (*FIRMS 1, 3, 7 and 12*), there were reported situations of resistance to change by employees. However, all these cases were solved by involvement of the board.

*j) Links between Portuguese enterprises, using interorganisational information systems, are basically constrained by lack of co-operation between managers and lack of knowledge to adapt IS/IT in order to get the full benefits of IOS. Successful EDI use in the firms studied was imposed by a large client.*



Contrary to what is suggested in the literature and in the data collected from the initial fieldwork, evidence was found that two of the most successful firms adopting IS/IT (*FIRMS 1* and *2*) put pressure on their customers to use interorganisational information systems. In *FIRM 2*, possibly because customers are small retailers without a strong bargaining power, the firm has succeeded. Nevertheless, in *FIRM 1* there are some concerns about the successful use of the interorganisational information system and the firm is still trying to convince its major customers (some large manufacturers of electrical appliances) to implement the system.

#### **6.8.5 – Summary and conclusions**

In this chapter, four levels of IS/IT success were defined in order to assess the level of IS/IT success of the firms that participated in the major case study research phase. According to the level of IS/IT adoption and assessed level of IS/IT success the firms were then analysed and clustered into four groups. A cluster sensitivity analysis was also performed to evaluate other potential alternatives to cluster the firms.

Each cluster of firms was analysed using a framework developed from the work of Pettigrew *et al.* (1989). Each factor previously identified in the literature (chapter 2) and in the initial fieldwork (chapter 3) as an enabler or inhibitor of IS/IT success was then studied individually and within each cluster. According to its assessed level of importance in determining IS/IT success, these factors were classified into four groups: *situational* factors, *determinant* factors, *consequent* factors and *not significant* factors. From the empirical evidence provided in the major case studies, a model was built in order to explain the underlying mechanisms, based on the interaction of factors and combinations of factors, that determine relative success with the adoption and use of IS/IT in Portuguese manufacturing SMEs.

The relationships between key actors in the process of IS/IT adoption and use were then discussed and mapped, for each firm and by cluster. The patterns found in each cluster were analysed with particular emphasis on the role of the *determinant* factors in explaining IS/IT success.

At the end of the chapter, the initial propositions developed after the initial fieldwork, and presented in chapter 3, were discussed and analysed according to the research findings. These findings lead to the argument that success with IS/IT adoption and use in Portuguese manufacturing SMEs can be explained by analysing the development of internal IS/IT competencies and management perspectives and attitudes towards IS/IT adoption and use. The combination of these two *determinant* factors is very important to achieving IS/IT success. Besides these determinant factors, some other factors were identified as enabling or inhibiting the level of IS/IT success (*situational* factors and *consequent* factors). However, evidence from the major fieldwork suggests that these

*situational* and *consequent* factors have a secondary level of importance. Their impact on the level of success with the adoption and use of IS/IT is indirectly achieved through the *determinant* factors.



## Chapter 7

### Theoretical validation of the findings

#### 7.1 - Introduction

In this chapter the findings presented in chapter 6 are analysed and compared with the existing research about the adoption and use of IS/IT in SMEs and with two organisational theories that have become more frequently used in the field of information systems: transaction cost theory (also called transaction cost economics) and resource-based theory.

The analysis of the findings in the light of existing theories is also justified by the adopted philosophical perspective. As Bhaskar (1989a) explains, a Realist perspective of social enquiry has the aim of explaining the underlying mechanisms that structure the actions of social actors through the use of theoretical frameworks. The structuring of the findings according to an existing management theory, which has been applied before in the field of information systems, has two objectives. First, it enables a theoretical validation of the findings based on a generally accepted theory, that already explains the existence of similar mechanisms in related areas of knowledge. Secondly, it extends the application of that theory into a new research area.

#### 7.2 - Transaction cost theory (transaction cost economics)

Transaction cost theory was essentially developed from the work of Coase (1937) and Williamson (1975). This theory is based on the idea that enterprises have costs when they buy in the market place those products or services which they do not make or provide themselves. These costs are called *transaction costs* and, according to the theory, they must be compared with the *production costs* of the firm, in order to decide whether to produce in-house or buy in the market. Access to markets is expensive because it implies *coordination costs*. *Coordination costs* are costs related to obtaining information about products and services, locating and communicating with suppliers, and monitoring contracts.

Williamson (1975) focuses his attention on the exchanges in which *opportunistic potential* is relevant. In his view, *opportunistic potential* exists when three necessary conditions occur: *asset specificity*, *small number of potential transactors*, and *imperfect information*. *Asset specificity* implies a condition of dependence upon the owner of a



specific asset. The existence of a *small number of potential transactors* increases this dependence because the asset cannot be easily replaced at a low cost. *Imperfect information* means that complete contingent contracts cannot be written. The “buyer” cannot fully incorporate into the contract the risk of later opportunism of the “supplier” by adjusting the price of the product/service it is selling. According to Williamson (1975), firms will exist when the *opportunistic potential* is significant. When *asset specificity*, *small number of contractors* and *imperfect information* are not significant, the *market* will dominate and transactions between contractors will occur.

The initial work of Williamson was further developed by him (see Williamson, 1979, 1993, 1996) and by other researchers. For example, Klein and Leffler (1981) argue that firms are not only searching for *opportunistic potential*, but that autonomous contractors also try to maintain their business relationships in order to avoid diseconomies in management.

An extensive analysis of the evolution of transaction cost theory was undertaken by Rindfleisch and Heide (1997). These researchers present a comprehensive model, developed from the literature, that explains the mechanisms inherent to transaction cost theory. In their view, *transaction costs* may result from *direct costs* or *opportunity costs* and these costs are related to three types of variables: *asset specificity*, *environment uncertainty* and *behavioural uncertainty*. They argue that *asset specificity* creates a safeguarding problem because the firm faces risks of productivity losses that result from lack of investment in specialised assets or high costs related to the production of an important specific asset that needs to be protected but that has little value outside the firm. *Environment uncertainty* is related to the existence of unanticipated changes surrounding an exchange. This creates adaptation problems, which may relate to communicating new information, renegotiating agreements, or coordinating activities. Finally, *behavioural uncertainty* is a performance evaluation problem, concerned with verification as to whether or not the contract is being accomplished and if the products and services defined in the contract are being provided.

Several criticisms have been levelled at transaction cost theory. Simon (1991) argues that the theory is divorced from reality and Granovetter (1985) states that it ignores the social context of human actions. According to Ghoshal and Moran:

*...organisations are not mere substitutes for structuring efficient transactions when markets fail; they possess unique advantages for governing certain kinds of economic activities through a logic that is very different from that of a market. TCE (Transaction Cost Economics) is 'bad for practice' because it fails to recognise this difference.*  
(Ghoshal and Moran, 1996: p.13)

Furthermore, these researchers argue that Williamson turns the concept of opportunism (a relatively unexplained phenomena) into a behavioural assumption. The concept of



*opportunism* is based on the assumption that decision makers may unscrupulously seek to serve their self interests and that it is impossible to know who is trustworthy and who is not (Barney, 1991; Rindfleisch and Heide, 1997; Williamson, 1975). However, Ghoshal and Moran (1996) argue that market mechanisms are designed to allow joint profit optimisation for business transactions. In their view, "Williamson's theory is not without its merit as a positive theory though, given its strong assumptions and extreme stylization, its usefulness is far more limited than it sometimes claimed" (Ghoshal and Moran, 1996: p.15). Rindfleisch and Heide (1997: p.47) reinforce this perspective by arguing that "the limited research on TCA's (transaction cost analysis) performance implications makes it difficult to assess fully its theoretical value and empirical validity".

In the field of information systems, the interest in transaction cost theory increased with the rising interest in studying the options of insourcing or outsourcing the IS/IT function (see for example, Grover *et. al.*, 1998; Willcocks and Lacity, 1998).

The findings of this research do not fit with the principles of transaction cost theory. One of the problems of transaction cost theory is that the *transaction costs* and the benefits that may be achieved from purchasing a service in the market are usually difficult to measure. Evaluating *transaction costs* and *production costs* is not an easy task and becomes more difficult when one is negotiating an intangible product, such as information and IS/IT services. On the other hand, the basic assumption of transaction cost theory is that the risk of opportunism creates a need for formalised governance structures. However, as several other researchers have also argued, "...trust, due to either social norms or personal relations, may serve as a substitute for formal mechanisms such as contracts and direct controls" (Rindfleisch and Heide, 1997: p.48).

In fact, most of the firms studied did not evaluate *the production costs* associated with the option of insourcing the IS/IT function or the *transaction costs* related to buying IS/IT services in the market. Firms developed IS/IT competencies in-house because managers believed they could not easily obtain from the market the IS/IT products and services they needed. In some cases, IS/IT products and services were provided by an external IS/IT firm. However evidence from the cases studied shows that what was supporting those business relationships were not written contracts (for example, in case 5, the person responsible for IS/IT did not know well the contract the firm had with the software house). Business relationships related to IS/IT products and services in the manufacturing SMEs studied were based on *trust*, and cost was not usually seen as an important variable. As Ghoshal and Moran (1993: p.42) suggest in their analysis of transaction cost theory, "in a theory of organisations and markets, learning and trust may well take the place that efficiency and opportunism occupy in the theory of markets and hierarchies".



In almost all the firms in clusters A, B, and C, the top managers and the IS/IT managers/experts interviewed declared that they were looking for personalised software systems which matched the core manufacturing processes of the firm. Because these systems are a specific asset, critical for the firm, managers wanted a stable relationship with the IS/IT supplier and were avoiding being dependent on a supplier whom they did not trust. The CEO of *FIRM 1*, when speaking about a process of software acquisition, illustrates this perspective by saying, “*we believed that when we would do business with a firm, we would be married for life, because of that we had to choose very carefully our partners*”.

### **7.3 - The essence of resource-based theory**

Resource-based theory has been developed to explain strategic management in organisations. This theory focuses on the idea of costly-to-copy attributes of the firm as sources of business returns and hence an essential way to achieve superior performance and competitive advantage (Barney, 1986; Conner, 1991; Hamel and Prahalad, 1996; Rumelt, 1987). According to resource-based theory, the firm looks for unique attributes that may provide superior performance. The firm is seen as a collection of productive resources. These resources can be classified into three categories: physical capital resources, human capital resources, and organisational resources (Barney, 1991).

Resources that cannot be easily purchased, that require an extended learning process or a change in the corporate culture, are more likely to be unique to the enterprise and, therefore, more difficult to imitate by competitors. It is argued that performance differentials between firms depend on having a set of unique inputs and capabilities (Conner, 1991). According to the resource-based theory, competitive advantage occurs only when there is a situation of resource heterogeneity (different resources across firms) and resource immobility (the inability of competing firms to obtain resources from other firms) (Barney, 1991).

The idea that complex internal capabilities are critical to a firm's success is not new (Selznick, 1957). However, the concepts of knowledge, capability and competence have aroused much interest (Amit and Schoemaker, 1993; Barney, 1991; Hamel and Prahalad, 1996; Prahalad and Hamel, 1990; Von Krogh and Roos, 1996). Frequently, in the literature, the words skills, competencies, capabilities, or organisational knowledge are used interchangeably. Furthermore, many studies found no significant differences in the use of the concepts "core competence" and "capabilities" (Von Krogh and Roos, 1996).

An interesting model shedding some light on the problem is presented in McGrath *et al.* (1995), and is further developed in Lambert and Bytheway (1998). These authors



establish a link between the concepts of capability and competence. Capability is defined as “the ability of an organisation to deliver a product or service into the market place” while competence is seen as “the ability to develop, manage and deploy resources in support of a capability or capabilities” (Lambert and Bytheway, 1988: p.3). Within this perspective, a competence is an organisational attribute resulting from the individual skills and knowledge of the members of the organisation.

Hamel and Prahalad also argue that a “competence represents the synthesis of a variety of skills, technology and knowledge streams” (1996: p.236). Therefore, in order to have a competence it is necessary to have an organisational context with processes enabling the effective application of individual skills and knowledge. Ciborra and Andreu (1998: p.89) express the concept of capability by saying that: “capabilities are developed by combining and using resources (and/or other capabilities) with the aid of organisational routines”. These authors explain that an organisational routine is “a particular way of doing what an organisation developed and learned” (Ciborra and Andreu, 1998: p.89).

Some other researchers regard competence from an individual perspective. For example, Von Krogh and Roos (1996: 107) argue that a competence enables “the application of knowledge to solve tasks in a known or unknown way” and present competence as the result of knowledge, experience, attitudes, and personal characteristics of an individual. In this study, the research object is the organisation as a whole and its ability to adopt and use IS/IT. Therefore, the concept of competence adopted is an organisational one, as presented in Lambert and Bytheway (1998). A *skill* is defined as the ability of an individual to apply his/her own personal characteristics and knowledge to solve tasks and, in this context, *knowledge* is the ability to apply information in order to understand a particular issue or situation.

Knowledge comes from learning how to apply information for problem solving (Tobin, 1997). However, in order to develop skills it is not only necessary to have know-how but it is also important to have the necessary conditions that enable the application of that know-how. In other works, one must not only know how to perform a task but also be physically able to perform that task. Von Krogh and Ross (1996) argue that there are tasks where particular individual characteristics are required for problem solving, besides the necessary knowledge that people may have to solve the problem. Figure 7.1 shows the relationships between the concepts of capability, competence, skills and knowledge, used within the context of this research.

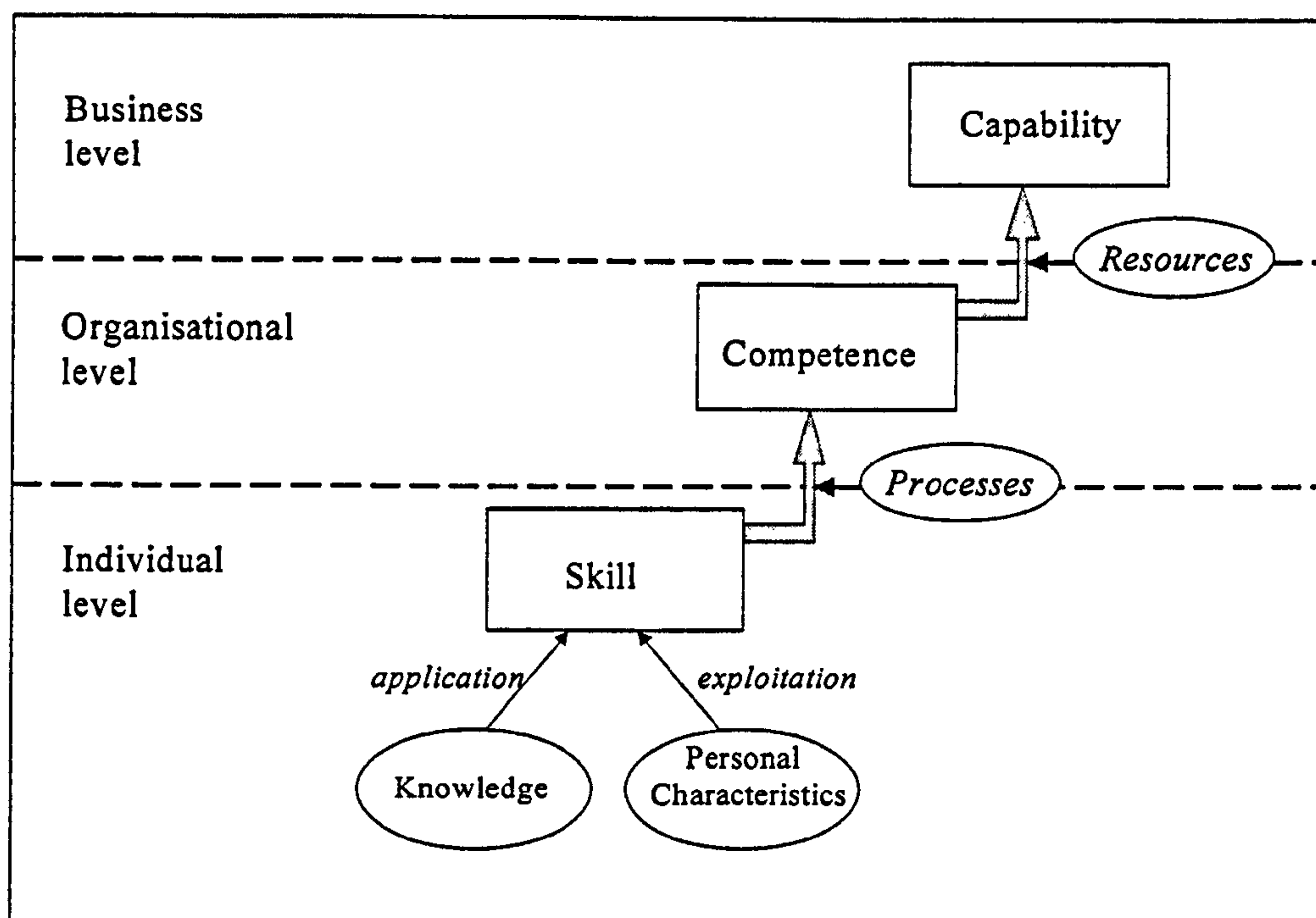


Figure 7.1 – Relationships between capabilities, competencies, skills and knowledge.  
 Source: Compiled by the author.

The resource-based theory treats enterprises as potential creators of value-added capabilities. The development of such capabilities and competencies involves a knowledge-based perspective (Conner and Prahalad, 1996; Prahalad and Hamel, 1990; Winter, 1988). Prahalad and Hamel (1990) concentrate their attention on the collective learning processes of the organisation, on the development of skills and technology integration. Their concept of “core competencies” is related to mechanisms by which firms learn and accumulate new skills in order to develop business capabilities to outrun competitors. One of the objectives of the theory is to help managers to appreciate why competencies can be perceived as a firms’ most valuable asset and, at the same time, to understand how those assets can be used to improve business performance.

Unlike transaction-cost economics (Williamson, 1975), a resource-based view of the firm does not depend on opportunistic behaviour. It focuses on developing internal knowledge and competencies to enable the firm to improve its competitiveness. It accepts that attributes related to past experiences, organisational culture and competencies are critical for the success of the firm (Campbell and Luchs, 1997; Hamel and Prahalad, 1996). Furthermore, it is argued that the identification of these attributes is a creative act and depends on managerial orientation, vision and intuition (Conner, 1991). Conner (1991: p.140) suggests that “an in-house team is likely to produce technical knowledge, skill, or routine that fits better with the firm’s current activities”. Hamel and Prahalad (1996) assert that skills and competencies must be built at an early stage in order to be effective in the future.



Barney (1991) explains that in order to provide competitive advantage a resource must fulfil four criteria:

1. Valuable: the resource must have strategic value to the firm (for example, by exploiting opportunities or neutralising threats);
2. Rare: the resource must be unique or rare to find amongst the current and potential competitors of the firm;
3. Imperfect immutability: It must not be possible to perfectly imitate or copy the resource (because it is difficult to acquire; because the link between the capability or the achieved sustained competitive advantage is ambiguous; or because it is socially complex);
4. Non-substitutability: competitors cannot substitute the resource by another alternative resource to achieve the same results.

As Grover *et al.* (1998) explain, “the essence of a resource-based theory is that given resource heterogeneity and resource immobility and satisfaction of the requirement of value, rareness, imperfect immutability, and non substitutability, firms’ resources can be a source of sustained competitive advantage” (p.84). Hamel and Prahalad (1996) argue that in order to exploit the core competence perspective the entire management team must participate in five key management tasks: identifying existing core competencies; establishing a core competence acquisition agenda; building core competencies; deploying core competencies; and protecting and defending core competence leadership.

#### **7.4 - The use of resource-based theory in the field of Information Systems**

Mata *et al.* (1995) looking at five attributes of IT (customer switching costs, access to capital, proprietary technology, technical IT skills and managerial IT skills) argue that managerial IT skills are the only one of these attributes that can provide sustainable advantage. According to these researchers managerial IT skills include:

1. the ability of IT managers to understand and appreciate the business needs of other functional managers, suppliers and customers;
2. the ability to work with these functional managers, suppliers and customers to develop appropriate IT applications;
3. the ability to co-ordinate IT activities in ways that support other functional managers, suppliers, and customers;
4. the ability to anticipate the future IT needs of functional managers, suppliers and customers.



Unlike technical IT skills that can be diffused relatively easily amongst a set of competing firms, managerial IT skills are usually developed over long periods of time, through learning and experience (Mata *et al.*, 1995; Katz, 1974). However, since technical IT skills are valuable to the firm, these skills may be a source of “temporary” competitive advantage, until competitors acquire their own IT skills (Mata *et al.*, 1995).

Other literature emphasises the importance of leadership and the relationship between the role of the CEO in relation to IS/IT (Earl and Feeny, 1994; Peppard and Ward, 1998). Feeny and Willcocks (1998a: p.20) state that “core IS capabilities are those necessary and sufficient to ensure that an organisation can exploit changing markets of technological services – to achieve business advantage through IT over time”. These researchers identified nine core IS/IT capabilities: IS/IT leadership; business systems thinking; relationship building; architecture planning; making technology work; informed buying; contract facilitation; contract monitoring and vendor development (Feeny and Willcocks, 1998a and 1998b). They argue that the development of IS/IT capabilities must be proactively planned before using external service providers and, in small businesses, for organisation’s employees it may not be practical to develop core IS/IT capabilities. Therefore, some of these capabilities may be developed by “insourcing”, using high-qualified IS/IT experts belonging to external organisations but working under the direction of in-house management.

Grover *et al.* (1998) state that, according to resource-based theory, outsourcing is a strategic decision which can be used with the purpose of filling the gap between the desired IS/IT capabilities of the firm and the actual ones. Grant (1991) argues that outsourcing not only maintains a firm’s stock of resources and capabilities but also augments resources and capabilities in order to buttress and extend positions.

Filling gaps of resources and capabilities through an outsourcing strategy may also inhibit the development of IS/IT capabilities in the firm, if top managers believe that by outsourcing IS/IT services they completely resolve the firm’s need to have IS/IT capabilities in-house. Ciborra and Andreu (1998) argue that IT is not only a technology to shape up a firm’s core capabilities but also has a role in incorporating these core capabilities into the organisational context of the firm by facilitating the learning process and enabling capability sharing and diffusion in the whole organisation.

### **7.5 - A resource-based approach to understand IS/IT adoption and use in manufacturing SMEs**

In this research, it is argued that the success of IS/IT adoption and use in manufacturing SMEs can be explained by resource-based theory. The development of internal IS/IT skills combined with top management support towards IS/IT adoption is the base to



provide superior levels of satisfaction with IS/IT adoption and use in manufacturing SMEs in Portugal.

The resources classified as determinant factors - IS/IT skills and top management perspectives and attitudes towards IS/IT adoption and use - are critical for the firm. Mata *et al.* (1995) explains that IS/IT managerial skills are a source of competitive advantage because these are socially complex, involving friendship, trust, and interpersonal relationships between senior management and IS/IT managers. Because of that, IS/IT managerial skills need long periods of time to develop, through experience and learning. Furthermore, managerial IS/IT skills are heterogeneously distributed across firms, valuable, and because of their social complexity they are not subject to low-cost imitation (Mata *et al.*, 1995).

In several of the firms studied, the personal relationships between CEO/top managers and the IS/IT managers, or the IS/IT suppliers, seemed to explain why those firms were successful adopting and using IS/IT. The IS/IT manager or the IS/IT supplier must have top managers'/owners' trust (essentially CEO's trust). Examples can be found in all the firms that showed positive levels of satisfaction with IS/IT adoption and use. As is expressed in the literature, in SMEs, informal relationships assume a very important role (Blili and Raymond, 1993; Martin and Staines, 1994; Olaison, 1990) and IS/IT is not an exception.

Unlike larger enterprises, in manufacturing SMEs even technical IS/IT skills can be a source of competitive advantage because SMEs usually have scarce financial resources and do not have the same ease of hiring qualified IS/IT experts. Moreover, it may be difficult to bring highly-qualified IS/IT experts to remote areas, far from major towns, (where many Portuguese manufacturing SMEs in traditional industries are located), as happens in *FIRM 10*. Therefore, qualified IS/IT expertise is likely to be more rare to find amongst SMEs. In *FIRM 2*, the CEO clearly states that he was "lucky" in finding his IS/IT manager/expert, a local young person that was interested in computers. As a matter of fact, this IS/IT manager/expert is a self-made man who received low formal education in computer science. In *FIRM 1*, the IS/IT experts developed their computer skills working in the firm. On the other hand, since most top managers in traditional manufacturing SMEs do not have much IS/IT expertise they may not be able to adequately evaluate the profile of the IS/IT experts that they need to hire. In the fieldwork, it was found that in some of the cases (*FIRM 5* and *FIRM 8*) the person responsible for IS/IT (who was not an IS/IT expert) did not seem to realise the professional limitations of the IS/IT people of the firm.

Top management perspectives and attitudes towards IS/IT adoption and use is a determinant factor for IS/IT success. In many traditional manufacturing SMEs the CEO and other top managers are the owners of the firm (as happens in all firms, except *FIRM 3* and *FIRM 6*) and have a critical role in decision making. They have the knowledge of



the business and are personally involved in most strategic, tactic and even operational decisions (Shuman *et al.*, 1985). In many cases these top managers/owners set up the firm (*FIRMs* 1, 2, 4, 5, 8, 10 and 11), have been there since its foundation. They are familiar with almost all the business processes, know all the employees, and directly negotiate with many of the customers and suppliers. They have the ultimate power to implement any process of change, because of their role in the organisational hierarchy and capital ownership. Their commitment is necessary to convince people to adopt and use IS/IT and to solve potential problems of resistance to change. In the cases where the CEO was not involved in IS/IT adoption, another senior manager with power in the organisation and whom the CEO/owners trusts (sometimes a relative, as happens in *FIRMs* 5, 7 and 11), must be directly involved, leading this process. In some of the cases studied, the CEOs also had a vision about the strategic use of IS/IT in the business (for example, in *FIRM 1* and *FIRM 10*). Top managers know the firm well and, due to that, they are in a privileged position to understand how IS/IT can be used to improve business performance. However, this must be complemented by the existence of internal IS/IT skills to develop or acquire computer-based systems.

In figure 7.2 an analysis of the determinant factors of IS/IT success, identified in the research, is presented with the major tasks associated with each of these factors.

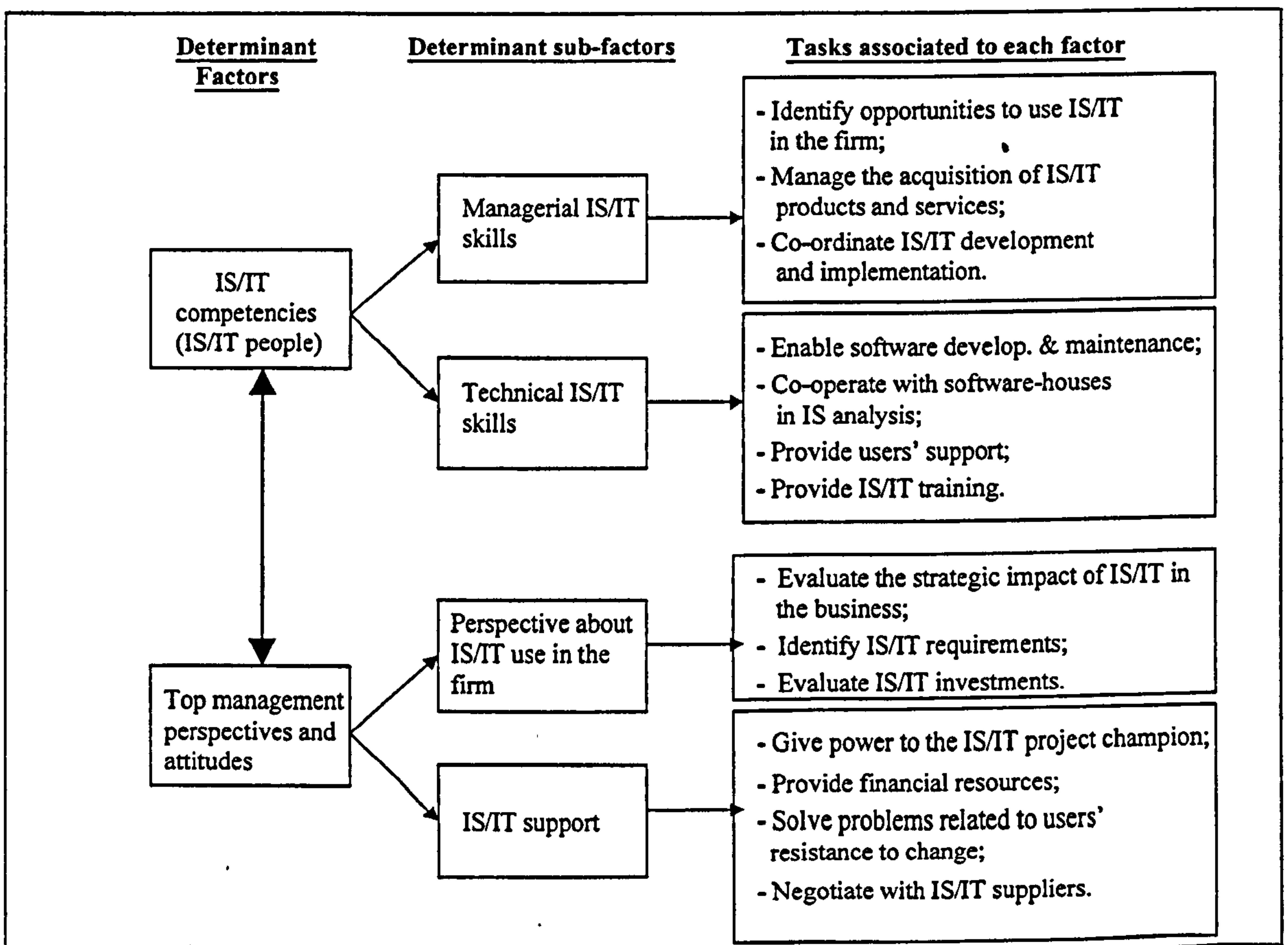


Figure 7.2 - Analysis of the *determinant* factors of IS/IT success.  
Source: Compiled by the author.



## **7.6 - Comparing the findings with previous SME literature**

The SME literature discussed in chapter 2 stresses several important characteristics of SMEs. Some of those, related to IS/IT adoption and use, will be analysed here in the light of the research findings:

- The dominant role of CEO/owners;
- Limited human and financial resources;
- Informal IS/IT management and no strategic planning for IS/IT;

### **a) The dominant role of the CEO/owners**

The CEO, usually the owner and entrepreneur, has the authority to influence other members of the business and he is likely to stop any resistance to change (Markus, 1983; Thong *et al.*, 1996). Power may come from several sources. Using Handy's (1976) framework for identifying sources of power in the organisation, the CEO is likely to have *position power*, because of the legitimacy of his/her role in the firm; *resource power*, since he/she is the one that gives promotions and pay increases; *expert power*, because of his/her knowledge of the business, accumulated through many years of experience; and *personal power*, due to his/her entrepreneurial characteristics and charisma. In SMEs, commitment from the top to the process of IS/IT adoption and use, seems to be extremely important.

### **b) Limited financial and human resources**

The findings from the research were consistent with the literature. Although financial resources were not found to be a significant constraint to IS/IT success, many SMEs had limited financial resources. However, firms invest in IS/IT if top management believes they will get benefits from those investments. The development of IS/IT skills is also limited by the difficulty of hiring qualified IS/IT experts. Nevertheless, firms showing positive levels of IS/IT satisfaction were able to get IS/IT experts in the market or develop their own IS/IT experts. On the other hand, the qualifications of IS/IT users were sometimes low and, in many firms, IS/IT training was crucial to develop their computer abilities.

### **c) Informal IS/IT management techniques and no strategic planning for IS/IT**

Evidence from the cases confirms the findings of previous research. The SMEs studied had a lack of use of formal managerial techniques. This is also reflected in the evaluation of IS/IT costs and benefits. In none of the firms was there a cost benefit evaluation and many top managers did not have a clear idea about the amounts of money invested in IS/IT. None of the firms were doing any strategic planning for information systems. Furthermore, no formal techniques for IS/IT analysis and design

were found. In the systems analysis phase, the identification of information systems' requirements was done using informal techniques, except when it was outsourced to IS/IT suppliers.

Figure 7.3 shows how some of the characteristics of SMEs identified in the literature are related to the *determinant* factors of IS/IT success.

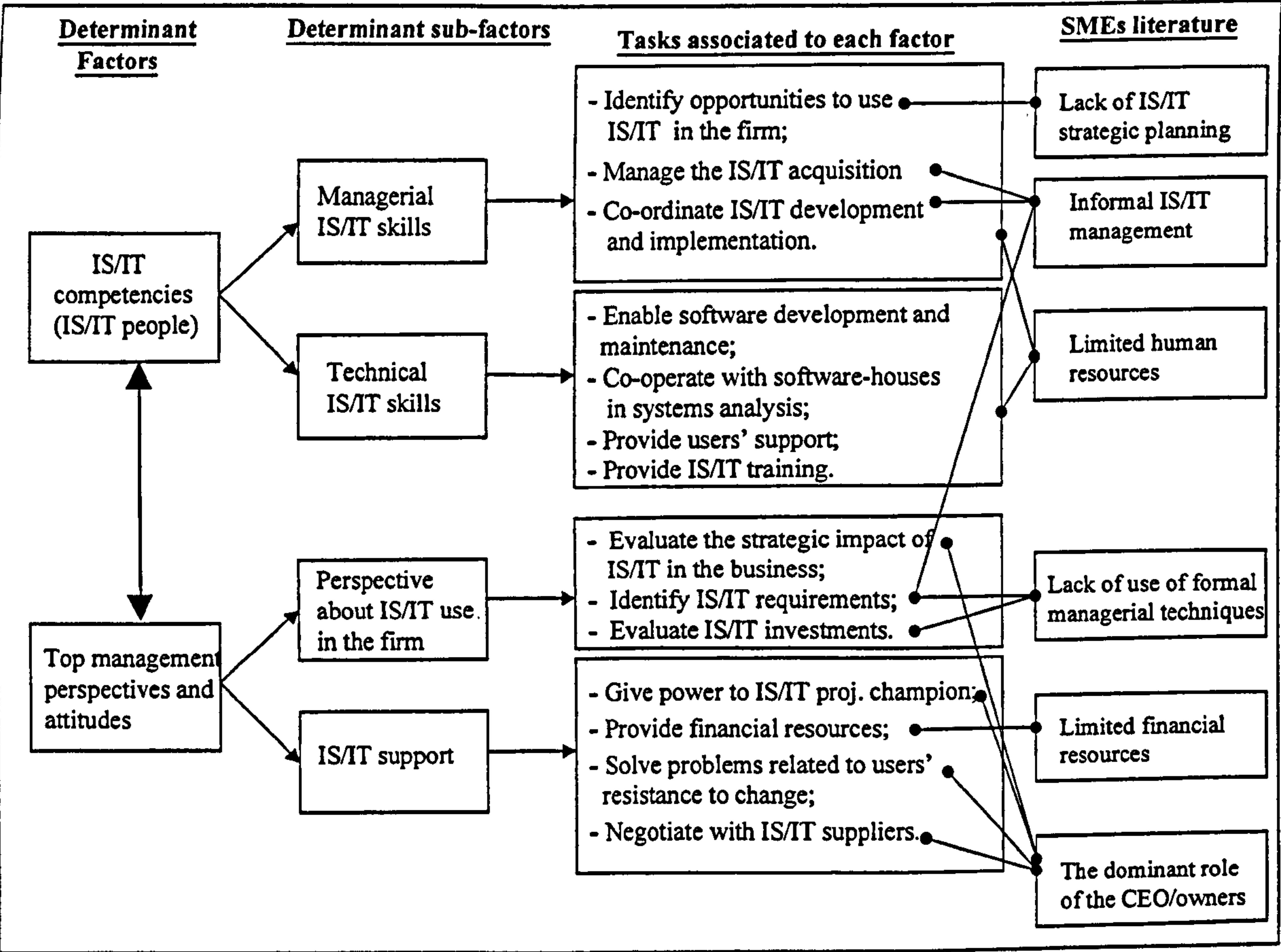


Figure 7.3 - Analysis of the *determinant factors* and their relation to the SMEs' literature.  
Source: Compiled by the author.



## 7.7 - A resource-based model to understand the successful adoption and use of IS/IT in manufacturing SMEs

Figure 7.4 exhibits a model that helps to understand the applicability of resource-based theory to explain the successful adoption and use of IS/IT in manufacturing SMEs. This model was developed from figure 7.1 and will be linked with the analysis of the factors related to IS/IT success, exhibited in figure 6.4 (chapter 6).

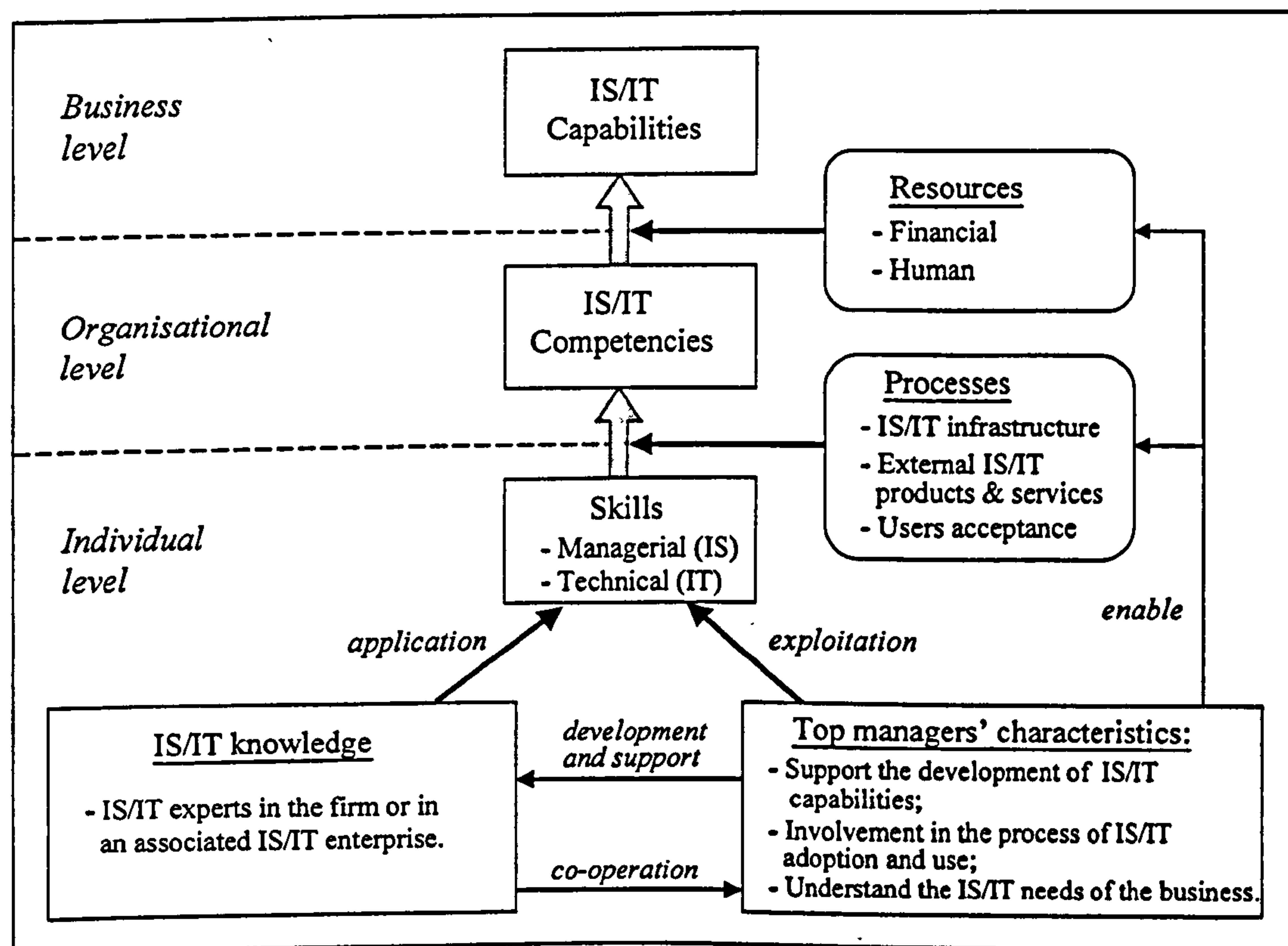


Figure 7.4 - A resource-based model to understand the successful adoption and use of IS/IT in manufacturing SMEs. *Source:* Compiled by the author.

There are two basic dimensions that sustain the whole model. The first one is the existence of IS/IT knowledge in the firm or in an associated IS/IT enterprise. The second concerns a top management that supports the development of IS/IT capabilities, is involved in the process of IS/IT adoption and use, and understands the IS/IT needs of the business.

The support of IS/IT capabilities includes: developing IS/IT knowledge in the firm by hiring and/or training IS/IT experts; providing the necessary resources for IS/IT adoption; and creating processes to transform IS/IT skills into IS/IT competencies. For example, the creation of an IS/IT infrastructure, through an IS/IT department or section, with full-time IS/IT staff, to plan, develop, select or maintain the computer-based information systems of the organisation.

The involvement of top management driving the process of IS/IT adoption is also important. It will help resolve problems of users' resistance to change and potential conflicts between managers in the organisation.

In the firms that were successful in adopting and using IS/IT, there was a process of co-operation between the IS/IT expert/manager and the owners/top managers in order to understand IS/IT needs of the business and manage the process of IS/IT acquisition/development.

Buying or contracting out IS/IT products or services is an option that needs to be carefully evaluated. However, the firms that were more successful adopting and using IS/IT adapted or developed their core software in-house or in an associated IS/IT enterprise. IS/IT competencies developed in-house tend to be unique and more difficult to imitate, providing the firm a potential source of competitive advantage.

IS/IT competencies to select or construct in-house computer-based information systems are achieved by having IS/IT skills involving all of IS/IT infrastructure, external IS/IT services and products, and users receptive to use IS/IT. The actual deployment of resources for IS/IT development or acquisition enables the IS/IT competencies of the firm to be transformed into IS/IT capabilities, as shown in figure 7.4. For example, CAD/CAM investments in the mould industry (*FIRM 1* and *FIRM 4*) and the integrated manufacturing software in the firms that operate in the clothing, textile and footwear industries (*FIRMS 2, 11* and *12*)

Each dimension in figure 7.4 is associated with a factor related to IS/IT adoption and success. These factors are described in chapter 6 and mapped in figure 6.4. The development of IS/IT knowledge is associated with IS/IT competencies (factor D1). On the other hand, top management understanding of business needs influences the type of IS/IT adopted (factor S5), IS/IT objectives (factor S6) and also the time of IS/IT adoption (factor S7). In a similar way, the business pressure to adopt IS/IT (factor C4) is associated with evaluating the IS/IT needs of the business.

The support given to IS/IT development by top managers and their involvement in the process of IS/IT adoption and use is expressed by factor D2 (top management perspectives and attitudes). The existence of an IS/IT infrastructure relates to factor C6 (people involved in IS/IT development). The external IS/IT products and services available express the following factors: IS/IT vendors support (C3); software availability (S3); and IS/IT external expertise (S4). Users acceptance is related to the following factors: user attitudes (C1), power conflicts (C2), and IS/IT training (C5). The financial and human resources in figure 7.4 are represented in chapter 6 by the factors S1 (financial resources) and S2 (human resources).



## **7.8 - Summary and conclusions**

In the Portuguese manufacturing SMEs studied, success with the adoption and use of IS/IT was achieved by firms that presented similar patterns in the way they approached and managed the process of IS/IT adoption and use. The model presented in figure 7.4 was developed to explain the behaviour of those firms in the light of resource-based theory. The following paragraphs discuss the identified patterns:

1. IS/IT knowledge was developed in-house or in an associated IS/IT enterprise. This knowledge was used to plan and develop computer applications in-house, to select and acquire IS/IT products and services in the market, or to contract out software development. The firm's relationship with the associated IS/IT enterprise must be enabled by business ownership or personal relationships, typical in the small business context. Personal relationships can be family ties or previous shared working or living experience of top managers in both firms. These enabled a context of trust and co-operation between partners in the development of the core applications of the manufacturing firm. In some of the cases studied, the manufacturing SME or some of its owners (and top managers) were, or had been, shareholders of the IS/IT supplier.
2. Top management has three important roles in the process of IS/IT adoption and use:
  - (i) The first one is supporting the development of IS/IT capabilities in the enterprise, by providing the necessary resources, processes, and IS/IT knowledge.
  - (ii) Second, top managers must be involved in and committed to the process of IS/IT adoption and use, solving problems of resistance to change and potential conflicts between the members of the organisation. These conflicts occurred due to changes in power as a result of IS/IT adoption.
  - (iii) The third role is related to understanding the IS/IT needs of the business. In the firms that were successful with IS/IT adoption and use, managers participated in the definition of the needs of the firm, in the selection, evaluation and negotiation of the IS/IT solutions. A strategic vision of the impact of IS/IT in the business is also important to acquire or develop computer-based information systems that enable the firm to have higher levels of performance or achieve competitive advantage by the use of IS/IT.
3. Evidence gathered in this research suggests that possessing IS/IT knowledge is insufficient to build IS/IT competencies (see for example *case 8*). In order to achieve IS/IT competencies it is necessary to develop processes to use the IS/IT skills available. These processes can be based in the IS/IT infrastructure of the firm

(to develop software in-house) or associated with the external context, by the selection and acquisition of IS/IT solutions in the market. However, most firms studied that presented positive levels of assessed IS/IT success did not seem to rely on the external context as an alternative to developing or buying their core applications. A positive commitment of the users to use the computer systems implemented is also a relevant factor. As explained above, in SMEs, top managers have an important role in the process of IS/IT acceptance by the users.

4. Although lack of resources is a common problem for SMEs, top managers in the firms that showed positive levels of assessed IS/IT success were providing resources to develop IS/IT capabilities. IS/IT adoption and use was seen as a strategic issue for the firm. There was not a formal cost/benefit evaluation of IS/IT investments because, although difficult to estimate, top managers believed that significant IS/IT benefits would be achieved. Two of the firms that showed low levels of assessed IS/IT success (*FIRM 6* and *FIRM 8*) were concerned with the financial resources necessary for IS/IT investments. On the other hand, the other firm in *cluster D*, *FIRM 9*, was amongst the ones that had invested more in IS/IT. However, this firm did not have much IS/IT knowledge, nor had they developed processes to enable the development of IS/IT competencies.

As discussed in this chapter, resource-based theory provides at least part of the explanation of IS/IT adoption and use in Portuguese manufacturing SMEs. The model presented in figure 7.4 is derived from the theoretical viewpoint of resource-based theory and includes the factors identified in this research which affect the assessed levels of success with the adoption and use of IS/IT in manufacturing SMEs.



## **Chapter 8**

### **Research conclusions**

#### **8.1- Summary of the research undertaken**

The literature review revealed little empirical research into the process of IS/IT adoption and use in manufacturing SMEs, and much of that is now out-of-date, due to the rapid evolution of IS/IT and the fact that many SMEs only recently started to implement IS/IT. This gap is even bigger in some countries, such as Portugal, where this research was done. Previous empirical research was mainly conducted through surveys that were useful in identifying “success factors” but inadequate in providing an in-depth understanding of a complex social subject involving a combination of multiple factors that are likely to cause different levels of IS/IT adoption and success.

A framework to analyse IS/IT adoption and use in SMEs was developed from a previous work of Pettigrew *et al.* (1989) that has been designed to study strategic change. This framework was used to structure the literature review and to analyse the data gathered from firms that participated in the preliminary study (initial fieldwork). The analysis of this data helped to define the case study interview content and to adapt the content and terminology of the framework prior to approaching the main case study research phase. The twelve firms that participated in the main case study phase were selected across different industries (footwear, textile, clothing, cement pipes, wine and mould industry), were expected to cover different levels of IS/IT adoption and provide different assessed levels of IS/IT success.

This research adopted a realist approach to social enquiry and it is argued that, in order to understand IS/IT success, it is important to understand the perspectives and roles of the key actors involved in the process of IS/IT adoption and use. The concept of IS/IT success was developed from the literature and essentially based on the concept of “user information satisfaction”.

The data were collected through semi-structured interviews with the key actors involved in the process of IS/IT adoption (CEOs, top managers, owners, senior managers, IS/IT managers, IS/IT experts, IS/IT vendors and IS/IT consultants). A questionnaire on the levels of IS/IT adoption and success was also completed by the participants and documents provided by the firms were examined. The data gathered were translated into English, coded, and analysed using a software package for qualitative data analysis, *NUD\*IST*. The data were analysed by firm, by factor, and by relative level of IS/IT adoption and success.

Several clusters were defined for data analysis according to the assessed level of IS/IT adoption and success (figure 8.1). Four distinct levels of IS/IT adoption and use were identified for the manufacturing SMEs that participated in the case study research. These levels are: a) enterprises using only administrative systems; b) enterprises that also had core manufacturing processes computerised; c) enterprises using integrated software systems for administrative and manufacturing purposes; d) enterprises that had achieved internal and external integration through administrative and manufacturing computer systems. The levels of IS/IT success were assessed based on the perceived level of IS/IT satisfaction of the interviewees: a) *success*; b) *satisfactory*; c) *less than satisfactory*; d) *unsuccessful*. Other clustering alternatives were also evaluated in order to check and validate the clustering criteria.

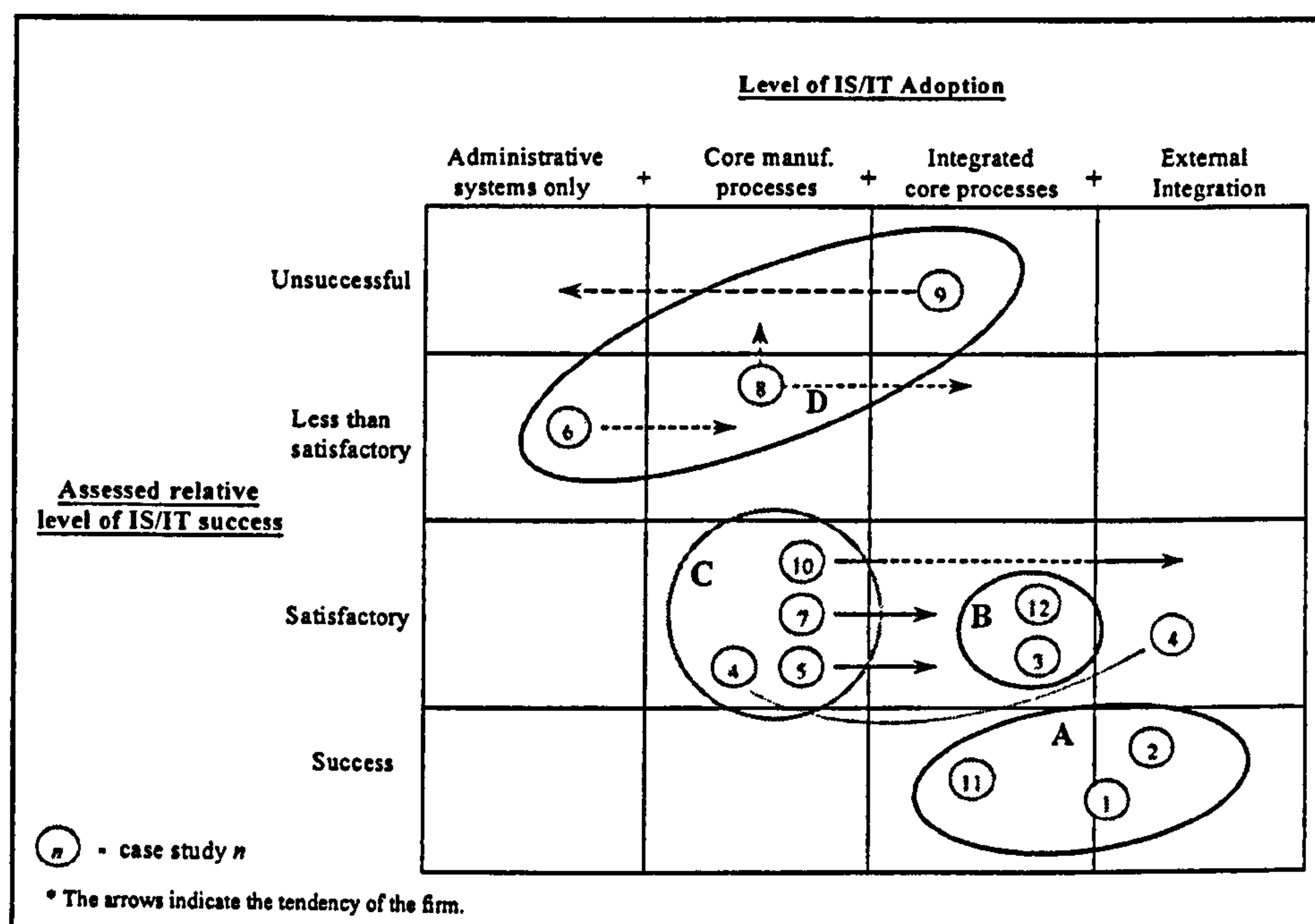


Figure 8.1 – The clusters of analysis.  
 Source: Compiled by the author.

A cross-case data analysis was conducted by comparing the relative importance of each factor in all the cases. The initial findings from factor analysis and cluster analysis were reviewed together and consolidated. The factors studied in the research were then classified into four groups according to their role and level of influence in determining IS/IT success (*situational factors*, *determinant factors*, *consequent factors* and *not significant factors*). Based on the interaction of combinations of factors, a model was built to explain the mechanisms that determine relative success with the adoption and use of IS/IT in Portuguese manufacturing SMEs. Relationships between key actors in the process of IS/IT adoption and use were also mapped and discussed for each firm and cluster. The patterns found in each cluster were then analysed with particular emphasis on the role of the *determinant factors* in explaining IS/IT success.



Finally, the research findings were evaluated in the light of existing literature about IS/IT in SMEs and two management theories used in the field of information systems: transaction cost theory and resource-based theory. The purpose of this analysis was to provide a theoretical validation of the findings within a broader context.

## **8.2 – Key research findings**

In this section, the research findings will be analysed in relation to the research questions.

### **8.2.1 – Research question 1:**

*What are the factors enabling or inhibiting the successful adoption and use of IS/IT in Portuguese manufacturing SMEs?*

The first research question pursued the following objectives:

- (i) check the validity of the factors identified in the literature as related to IS/IT adoption and success in SMEs in the context of the Portuguese manufacturing industry;
- (ii) find some new factors related to IS/IT adoption and success that might not have been documented in the literature, some may be particular to the Portuguese manufacturing industry;
- (iii) evaluate the relevance of these factors in determining IS/IT success in Portuguese manufacturing SMEs.

An individual analysis of potential enablers and inhibitors of IS/IT success revealed different levels of influence of these factors which were classified into four groups: *situational factors*, *determinant factors*, *consequent factors* and *not significant factors*. The analysis of the data suggests the conclusion that IS/IT success was associated with very similar combinations of the *determinant factors*. The *situational* and *consequent* factors have a secondary level of importance. Their impact on the level of success is indirectly achieved through the *determinant* factors. *Not significant factors* are factors that were not found relevant to explain the level of IS/IT success. Figure 8.2 shows a list of the factors identified and their relative importance in determining IS/IT adoption and success in the Portuguese manufacturing SMEs.

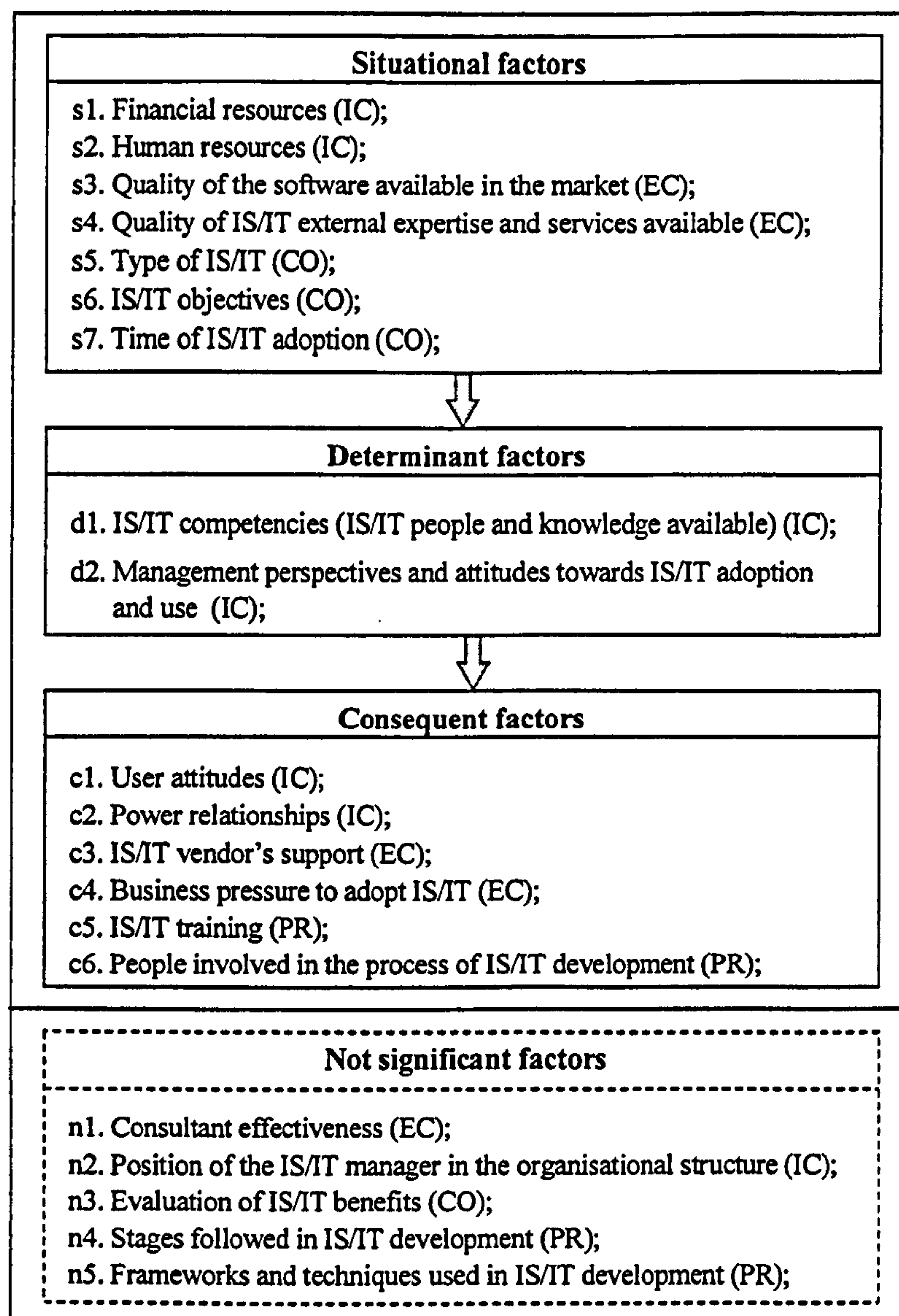


Figure 8.2 – Classification of factors associated with IS/IT adoption and success.  
Source: Compiled by the author.

### 8.2.2 - Research question 2:

*How do these factors and sets of factors relate to each other and determine relative success in the adoption and use of IS/IT in Portuguese manufacturing SMEs ?*

The combinations of factors that affect IS/IT adoption and success can be explained at two levels: first, by analysing the factors and combinations of factors found in the clusters studied; second, by presenting a resource-based model of IS/IT adoption and success in the Portuguese manufacturing SMEs.



Having clustered the firms studied based on the assessed level of IS/IT adoption and success (see figure 8.1), a systematic analysis of the data showed evidence of clear patterns amongst the firms in each of the clusters studied. Firms that were more successful in adopting and using IS/IT (*cluster A*) showed similar patterns of factors and relationships between factors. In some cases, those patterns were also presented in the firms in *clusters B and C*. Firms that displayed lower levels of success with IS/IT exhibited completely different patterns (*cluster D*). Figure 8.3 shows how these factors and combinations of factors related to IS/IT adoption and success are associated to each other.

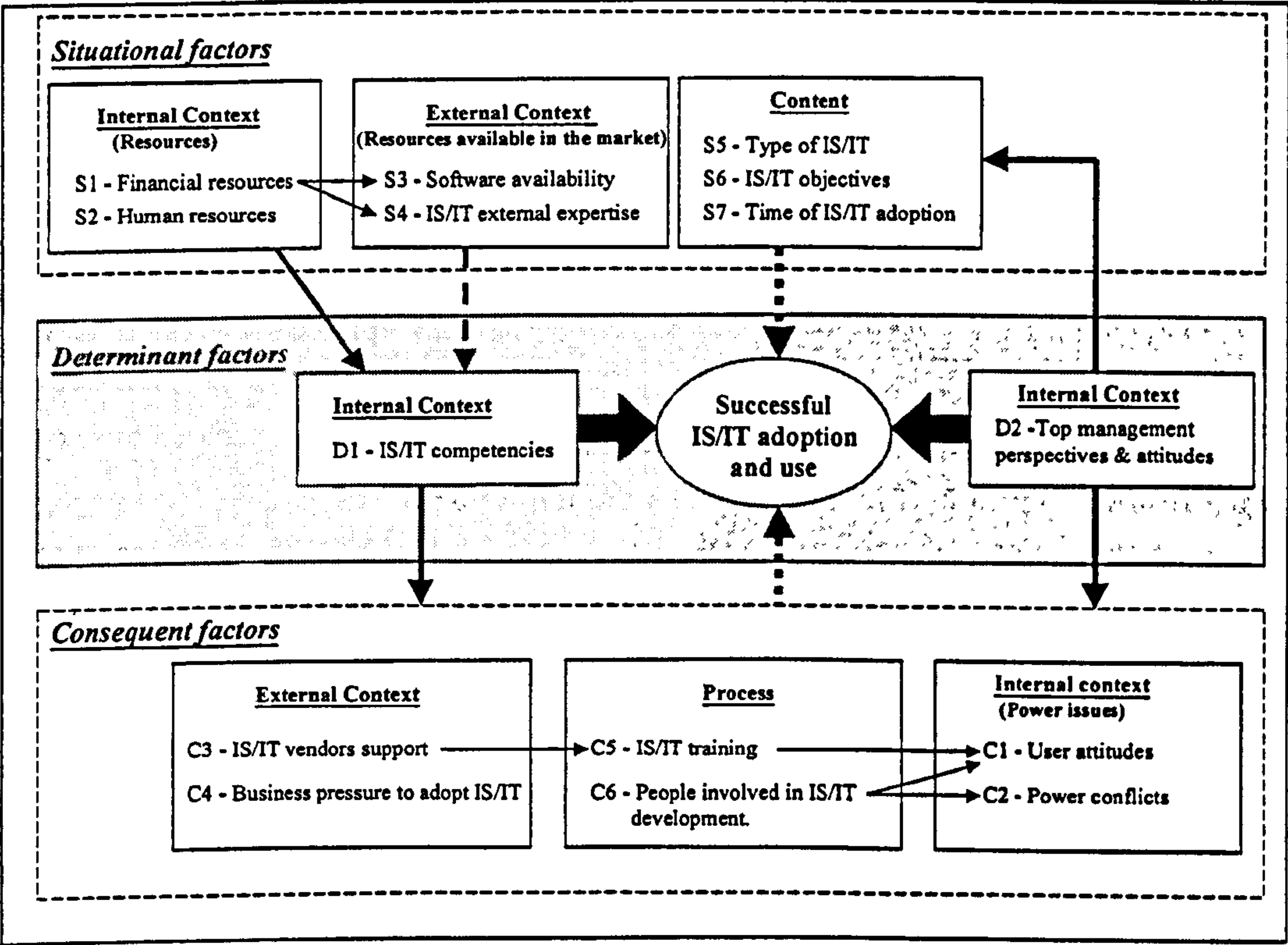


Figure 8.3 – Relationships amongst factors affecting IS/IT adoption and success.  
Source: Compiled by the author.

A model illustrating the process of IS/IT adoption and use was developed (figure 8.4) showing how resource-based theory can be used to explain IS/IT adoption and success in manufacturing SMEs. This model, discussed in detail in chapter 7, is also reproduced in figure 8.4.

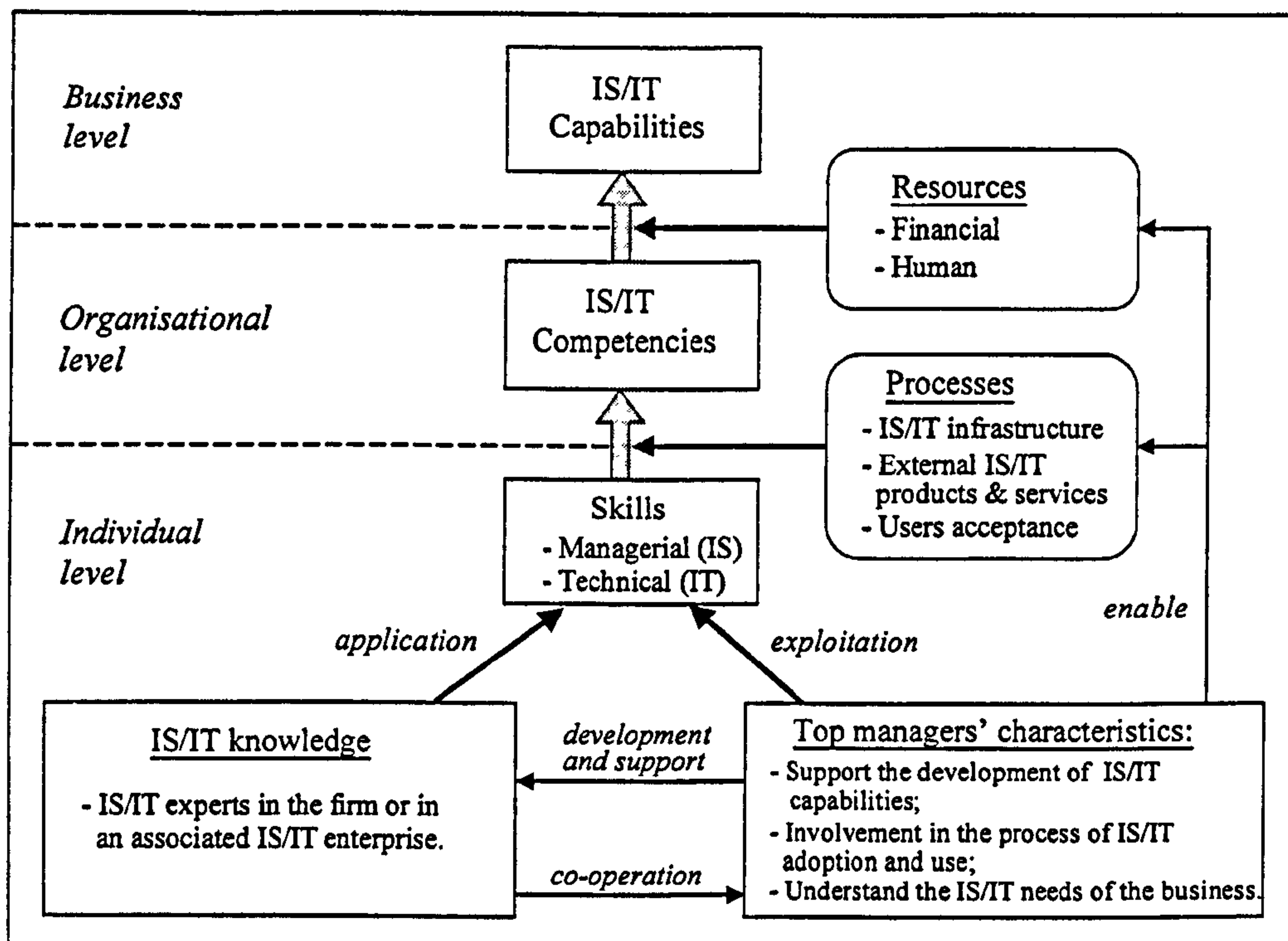


Figure 8.4 - A resource-based model to explain the successful adoption and use of IS/IT in manufacturing SMEs. *Source:* Compiled by the author.

The key findings of the research related to the second research question are:

- (i) This research demonstrates that a combination of factors were determinant in explaining IS/IT adoption and success. They are related to the involvement and commitment of the top managers through out the process of IS/IT adoption and use, and to the development of IS/IT competencies, in-house or in closely associated enterprises.
- (ii) Evidence from the cases clearly establishes that higher levels of success with IS/IT adoption and use were achieved in the firms where top managers:
  - Provided the necessary resources to deliver IS/IT capabilities in-house or in an associated IS/IT enterprise, without concern for cost. Internal IS/IT competencies were established to develop computer applications but also to select and acquire IS/IT products and services in the market or contract out software development;
  - Were personally involved in leading the process of IS/IT adoption or empowered a manager with IS/IT expertise to lead this process in close co-operation with the top managers. In the firms with assessed positive levels of IS/IT satisfaction, the person in charge of IS/IT was either the manufacturing manager or an IS/IT professional. In all the firms that were *unsuccessful* with



IS/IT adoption and use, the finance or the administrative manager was the person responsible for IS/IT. Since manufacturing software is the core software of the firm, manufacturing managers are, when compared with finance or administrative managers, in a better position both to understand the critical information needs of the firm and implement the core applications.

- Established business relationships with IS/IT suppliers based on personal relationships (frequently family ties) or ownership of the IS/IT enterprise, rather than on contractual relationships;
- Actively participated in the selection, evaluation and negotiation of IS/IT solutions in collaboration with the IS/IT professionals of the firm and external partners;
- Were personally involved in solving problems of resistance to change and potential power conflicts between the members of the organisation;

(iii) This research also provided evidence to support the applicability of resource-based theory to understand and explain success with the adoption and use of IS/IT in Portuguese manufacturing SMEs.

IS/IT competencies developed in-house tend to be unique and more difficult to imitate, and provide the firm a potential source of competitive advantage through the use of IS/IT. Firms that were more successful adopting and using IS/IT did not rely on external IS/IT solutions as an alternative to the development of IS/IT competencies in-house. They were searching for new ways of applying IS/IT to the business and investing in IS/IT competencies, without concern for the cost.

In these firms, access to unique software was not seen as critical for the business and many were even open to sell their software to potential competitors. The objective of these firms was being a step ahead of competitors in the use of their IS/IT knowledge.

Management viewed IS/IT as a dynamic, constantly changing variable. In order to cope with this process of change and have core software permanently fitting the requirements of the business, these firms developed IS/IT competencies in-house. This enabled the delivery of capabilities by providing resources in the organisation or from an associated IS/IT enterprise, instead of merely acquiring IS/IT products in the market.

In contrast, in the firms with lower levels of IS/IT success, the existing problems with the adoption and use of IS/IT were frequently pointed out as due to the external context. These firms lacked IS/IT competencies and top management was not able to understand and manage the process of IS/IT adoption and use. They were looking for solutions outside the firm, with little awareness of the need to develop IS/IT competencies in-house, in order to obtain and deploy the systems they required.



### **8.3 – Contribution to knowledge**

The study's contribution to the existing body of knowledge can be seen from several perspectives that are related to the research subject, the research method, and the research context.

#### **8.3.1 - Research subject**

This research contributes to knowledge by providing academics and practitioners with a detailed and original explanation of the factors and combinations of factors that are likely to affect success with the adoption and use of IS/IT in manufacturing SMEs.

Although many manufacturing SMEs have been increasingly investing in IS/IT, they traditionally lack knowledge about how to manage the process of IS/IT adoption and use. The research provides a framework which enables small business managers and IS/IT professionals to diagnose why the firm is achieving a certain degree of success and to take specific action to address the reason for IS/IT lack of success. Furthermore, this research presents a new model that explains how factors and combinations of factors related to IS/IT success can be explained within the principles of resource-based theory.

The study establishes evidence that SMEs can use IS/IT innovatively and strategically, and achieve business benefits that might not be expected from firms that usually have very limited resources. The work further demonstrates that the study of SMEs can contribute to the development of theory in the field of information systems. Some of the SMEs studied achieved significant influence in the development of the use of IS/IT in their industry and are interesting cases to be studied in-depth by academics in order to generate theory that could be applied to larger enterprises. The existing literature provides evidence that SMEs have characteristics that provide them advantage when compared with large enterprises, such as flexibility and fast decision making. Those characteristics are important variables that can enable the adoption and use of innovative IS/IT solutions in the business.

#### **8.3.2 - Research context**

This study explores, structures, and validates inhibitors and enablers of IS/IT success within a specific context - the Portuguese manufacturing industry. Although Portuguese industry is dominated by SMEs, there is lack of research in Portugal about this topic and, as empirical evidence demonstrates, many SMEs have encountered difficulties in managing the process of IS/IT adoption and use. The findings can help many Portuguese manufacturing SMEs to reach higher levels of success with IS/IT adoption



and use and to be more competitive in traditional industries that are facing serious strategic challenges.

### **8.3.3 - Research method**

A research strategy drawing on a realist perspective of science is unusual in the field of information systems. As Galliers (1997) points out, American research in the field of Information Systems, usually following a positivist approach, is very rigorous but with limited practical relevance while most European research, usually following a more interpretive approach, tends to be practically valuable but has less “scientific” rigour. A realist approach enables the researcher to overcome some of the limitations entailed in either of these perspectives. Following a more “scientific” perspective, realism overcomes the high levels of subjectivity that characterise pure interpretive approaches whilst, at the same time, enabling an in-depth study of the mechanisms that explain social phenomena.

The study was designed from a realist perspective and thus has delivered a methodological contribution to existing IS research. The realist perspective of social enquiry has proven to be a viable approach to case study research in the field of information systems. Realist research focuses on understanding the underlying mechanisms and social structures that generate social phenomena. As a result, the study was able to elicit a number of interrelated models that help to understand and explain success with IS/IT adoption and use in manufacturing SMEs.

## **8.4 – Limitations of the study and opportunities for further research**

Several opportunities for further research were identified. Some of these opportunities derive from the limitations of the study.

- (i) This research was essentially exploratory and the findings were inducted from empirical evidence. Deductive research might be carried out, using quantitative research methods, in order to test the validity of some of the findings across the entire population of Portuguese manufacturing SMEs.

This research has used unstructured and semi-structured interviews which allowed the interviewees to express their perceptions and interpretations unconstrained and provided the researcher with a deeper understanding of the social dimension associated with the process of IS/IT adoption and use. IS/IT adoption is a complex subject, with both social and technical dimensions, and surveys have limitations studying complex social phenomena.

- (ii) This study was conducted in the context of the Portuguese manufacturing industry. Although the same findings are expected to be found in other manufacturing

SMEs operating in similar contexts, further research needs be conducted, in other countries, using the same approach, in order to understand variations due to differences in the national culture or in the economic environment. As was said earlier, national culture exerts a subtle influence on individuals and organisations and cultural issues can only be studied through specifically designed cross-cultural studies. Further research might address the large scale extrapolation of cross-cultural differences in the use and adoption of IS/IT in SMEs.

- (iii) Since the principles related to IS/IT success identified in this research are not based on technology differences but on management relations, some of the findings should be applicable in a wider range of contexts. Firms operating in non-manufacturing SME industries, such as tourism, or larger firms in similar traditional manufacturing industries may display similar patterns. Further research needs to be conducted to examine the applicability of the findings obtained from this research to other contexts.
- (iv) To date the use of resource-based theory to explain particular organisational phenomena, such as IS/IT adoption has been limited. This study provides evidence that resource-based theory can be used to explain the development of IS/IT in organisations. Based on the findings identified in this study, there is also an opportunity to conduct deductive research and extend resource-based theory to study the use and management of information systems and technology in other contexts.

In conclusion, this research achieved its objectives. By researching a relatively neglected topic and collecting and analysing detailed evidence from twelve case studies, the findings are not only of importance in the particular research context but also add significant new insights to the existing theory of knowledge about IS/IT adoption and success. It is believed the results of this work will be of direct practical value as well as contribute to theoretical understanding. The output of this study should provide valuable input to further research.



## Bibliography

- ABELL, A. (1993). "Providing information for small firms at Business Link Hertfordshire", *Business Information Review*, 10(2), 48-55.
- AHITUV, N. (1980). "A systematic approach towards assessing the value of an information system", *MIS Quarterly*, 4(4), 61-75.
- ALLOWAY, R. (1980). "Defining success for data processing. A practical approach for the strategic planning for the DP department", CISR working paper n°52, MIT.
- ALPAR, P. and EIN-DOR, P. (1991). "Major IS concerns of intreprenurial organisations", *Information and Management*, 20, 1-11.
- AMIT, R. and SCHOEMAKER, P. (1993). "Strategic assets and organisational rent", *Strategic Management Journal*, 14, 33-46.
- ATTEWELL, P. (1992). "Technology diffusion and organizational learning: The case of business computing", *Organization Science*, 3(1), 1-19.
- BACKHOUSE, J. and LAND, F. (1991). "On the discipline of Information Systems", *Journal of Information Systems*, 1, 19-23.
- BAILEY, J.E. and PEARSON, S. (1983). "Development of a tool for measuring and analysing computer user satisfaction", *Management Science*, 29(5), 530-545.
- BAKER, S. (1996). *Extending the means-end theory through an investigation of the consumer benefit/price sensivity relationship in two markets (UK and Germany)*, Unpublished PhD thesis, Cranfield University.
- BAKER, W. (1987). "Status of information management in small business", *Journal of Systems Management*, 38(4), 10-15.
- BAKER, W.; ADDAMS, H. and DAVIS, B. (1993). "Business planning in successful small firms", *Long Range Planning*, 26(6), 82-88.
- BARNEY, J. (1986). "Strategic factor markets: Expectations, luck and business strategy", *Management Science*, 32, 1231-1241.
- BARNEY, J. (1991). "Firm resources and sustainable competitive advantage", *Journal of Management*, 17(1), 99-120.
- BAROUDI, J.; ORLIKOWSKI, W. (1988). "A short-form measure of user information satisfaction: A psychometric evaluation and notes on use", *Journal of Management Information Systems*, 6(4), 44-59.
- BAROUDI, O.; OLSON, M. and IVES, B. (1986). "An empirical study of the impact of user involvement on system usage and information satisfaction", *Communications of the ACM*, 29(3), 232-238.
- BARROW, C. (1993). *The Essence of Small Business*, Prentice Hall, New York.
- BASKERVILLE, R. and WOOD-HARPER, T. (1996). "A critical perspective of action research as a method for information systems research", *Journal of Information Technology*, 11, 235-246.



- BENBASAT, I.; GOLDSTEIN, D. and MEAD, M. (1987). "The case study research in studies of information systems", *MIS Quarterly*, 11(3), 369-386.
- BENJAMIN, R.; DE LONG, D. and SCOTT-MORTON, M. (1990). "Electronic Data Interchange - How much competitive advantage ?", *Long Range Planning*, 23(1), 29-40.
- BENJAMIN, R.; ROCKART, J.; SCOTT MORTON, M.; WYMAN, J. (1984). "Information technology: A strategic opportunity", *Sloan Management Review*, 25(3), 3-10.
- BERGERON, F. and RAYMOND, L. (1992). "Planning of IS to gain a competitive edge", *Journal of Small Business Management*, Jan., 21-26.
- BHALLA, A. (Ed.) (1992). *Small and Medium Enterprises - Technology, Policies and Options*, Intermediate Technology Publications / United Nations.
- BHASKAR, R. (1978). *A Realist Theory of Science*, 2nd edition, Harvester, Brighton.
- BHASKAR, R. (1986). *Scientific Realism and Human Emancipation*, Verso, London.
- BHASKAR, R. (1989a). *Reclaiming Reality*, Verso, London.
- BHASKAR, R. (1989b). *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*, 2nd edition, Harvester, Hemel Hempstead.
- BIRCH, D. (1979). "The job generation process", *MIT working paper*, Cambridge (Massachusetts).
- BIRCHALL, D.; CHANARON, J. and SODERQUIST, K. (1996). "Managing innovation in SME's: A comparison of companies in the UK, France and Portugal", *International Journal of Technology Management*, 12(3), 291-305.
- BIRLEY, S. (1982). "Corporate strategy and the small firm", *Journal of General Management*, 8(2), 82-86.
- BIRLEY, S. and WESTHEAD, P. (1990). "Growth and performance contrasts between 'types' of small firms", *Strategic Management Journal*, 11, 535-557.
- BLAIKIE, N. (1993). *Approaches to Social Enquiry*, Polity Press, Cambridge.
- BLILI, S. and RAYMOND, L. (1993). "IT: Threats and opportunities for small and medium-sized enterprises", *International Journal of Information Management*, 13(6), 439-448.
- BOEKER, W. (1989). "Strategic change: The effects of founding and history", *Academy of Management Journal*, 32, 489-515.
- BOLAND, R. (1985). "Phenomenology: a preferred approach to research on information systems" in MUMFORD, E.; HIRSCHHEIM, R.; FITZGERALD, G.; and WOOD-HARPER, T. (Eds), *Research Methods in Information Systems*, North-Holland, New York.
- BOLTON, J. E. (1971). *Report from the Committee on Inquiry on Small Firms*, Cmnd 4811, HMSO, London.
- BONK, E. (1996). "The information revolution and its impact on SME strategy: The Asia pacific economic cooperative forum as a model", *Journal of Small Business Management*, Jan., 71-77.
- BOWMAN, C. and ASH, D. (1996). *Managing Strategy*, MacMillan, London.
- BOWMAN, C. and JARRETT, M. (1996). *Management in Practice*, 3rd edition, Butterworth-Heinemann, Oxford.



- BRABANDER, S. and THIERS, G. (1984). "Successful information systems development in relation to situational factors which affect effective communication between MIS-users and EDP-specialists". *Management Science*, 30(2), 137-155.
- BRACKER, J.; and PEARSON, J. (1986). "Planning and financial performance of small, mature firms", *Strategic Management Journal*, 7(6), 503-522.
- BRACKER, J.; KEATS, B. and PEARSON, J. (1988). "Planning and financial performance among small firms in a growth industry", *Strategic Management Journal*, 9, 591-603.
- BRAGANZA, A. (1993). "EDI developments around Europe" in WALDEN, I. and BRAGANZA, A. (Eds). *EDI - Audit and Control*, NCC Blackwell, Manchester.
- BRIDGE, S.; O'NEILL, K. and CROMIE, S. (1998). *Understanding Enterprise, Entrepreneurship, and Small Business*, MacMillan, London.
- BRISLIN, R. (1993). *Understanding Culture's Influence on Behaviour*, Harcourt Brace Jovanovich Publishers, Orlando.
- BRUWER, P. (1984). "A descriptive model of success for computer-based information systems, *Information and Management*, 7(7), 63-67.
- BRYNJOLFSSON, E.; MALONE, T.; GURBAXINI, V. and KAMBIL, A. (1994). "Does information technology lead to smaller firms?", *Management Science*, 40(12), 1628-1644.
- BULL, A.; PITT, M. and SZARKA, J. (1993). *Entrepreneurial Textile Communities - A comparative study of small textile and clothing firms*, Chapman & Hall, London.
- BURNS, P. and DEWHURST, J. (Eds) (1986). *Small Business in Europe*, MacMillan, London.
- BURRELL, G. and MORGAN, G. (1979). *Sociological Paradigms and Organisational Analysis*, Heinemann, London.
- BURT, D. (1978). "Planning and performance in Australian retailing", *Long Range Planning*, 11, 62-66.
- BYTHEWAY, A. and DHILLON, G. (1996). "Significance of partnerships in the management of interorganisational systems", *International Journal of Information Management*, 16(5), 369-380.
- CALDEIRA, M. and DHILLON, G. (1996). "Interorganisational systems as a basis for collaborative strategies: experiences from the clothing and textile industry", *Proceedings of the 6th Annual Conference - BIT'96*, Manchester Metropolitan University, 7th November, 51-58.
- CALDEIRA, M. and DHILLON, G. (1997). "Factors affecting the use and adoption of EDI in manufacturing SMEs: experiences from Portugal", *Proceedings of the 5th European Conference on Information Systems*, Cork, Cork Publishing Limited, 1184-1190.
- CAMPBELL, A. and LUCHS, K. (1997). "Understanding competencies" in CAMPBELL, A. and LUCHS, K. (Eds), *Core Competency-based Strategy*, Thomson, London.
- CARRIER, C. (1991). "Intrepreneurship et PME", *Gestion*, November, 20-27.
- CARSON, D.; CROMIE, S.; MCGOWAN, P. and HILL, J. (1995). *Marketing and Entrepreneurship in SMEs - An Innovative Approach*, Prentice Hall, Hemel Hempstead.
- CARVALHO, C.; CORREIA, A.; COSTA, E.; FERREIRA, D.; FONSECA, M. and WILSON, T. (1993). "Information services to industry in Northern Portugal: Planning RIA (Rede de



- Informação Associativa)", *International Journal of Information Management*, 13, 113-124.
- CASH, J. and KONSYNSKI, B. (1985). "IS redraws competitive boundaries", *Harvard Business Review*, March/April, 134-142.
- CERULLO, M. (1980). "Information systems success factors", *Journal of Systems Management*, 31(12), 10-19.
- CHARAN, R.; HOFER, C. and MAHON, J. (1980). "From entrepreneurial to professional management: a set of guidelines", *Journal of Small Business Management*, 18(1), 1-10.
- CHAU, P. Y. (1994). "Selection of packaged software in small businesses", *European Journal of Information Systems*, 3(4), 292-302.
- CHECKLAND, P. and SCHOLLES, J. (1990). *Soft Systems Methodology in Action*, John Wiley, Chichester.
- CHELL, E. and HAWORTH, J. (1992). "The competitive performance of SMEs in the UK clothing industry", *International Small Business Journal*, 10(3), 11-24.
- CHEN, J. and WILLIAMS, B. (1993). "The impact of microcomputers on small businesses: England 10 years later", *Journal of Small Business Management*, July, 97-102.
- CHEN, M. and HAMBRICK, D. (1995). "Speed, stealth, and selective attack: How small firms differ from large firms in competitive behavior", *Academy of Management Journal*, 38(2), 453-482.
- CHENEY, P. (1983). "Getting the most out of your first computer system", *American Journal of Small Business*, 7(4), 50-60.
- CHURCHILL, N. and LEWIS, V. (1983). "The five stages of small business growth", *Harvard Business Review*, 61, May/June, 30-50.
- CIBORRA, C. (1994). "The grassroots of IT and strategy" in CIBORRA, C. and JELASSI, T. *Strategic Information Systems - A European Perspective*, John Wiley & Sons, Chichester.
- CIBORRA, C. and ANDREU, R. (1998). "Organisational learning and core capabilities development: The role of IT", in GALLIERS, R. and BAETS, W. (Eds). *Information Technology and Organisational Transformation – Innovation for the 21<sup>st</sup> Century Organization*, John Wiley & Sons, Chichester.
- CLAPHAM, S. and SCHWENK, C. (1991). "Self-serving attributions, managerial cognition, and company performance", *Strategic Management Journal*, 12, 219-229.
- COASE, R. (1937). "The nature of the firm", *Econometrica*, 4, 386-405.
- COCHRAN, A. (1981). "Small business mortality rates: A review of the literature", *Journal of Small Business Management*, 19(4), 50-59.
- COE, L. (1996). "Five small secrets to systems success", *Information Resources Management Journal*, 9(4), 29-38.
- COELHO, J. *et al.* (1995). *Novas Tecnologias da Informação - Um Caminho para Portugal* ("New Information Technologies - A Way for Portugal"), Unpublished working paper.
- CONNER, K. (1991). "A historical comparison of resource-based theory and five schools of thought within industrial organization economics: Do we have a new theory of the firm?", *Journal of Management*, 17(1), 121-154.



- CONNER, K. and PRAHALAD, C. (1996). "A resource-based theory of the firm: Knowledge versus opportunism", *Organization Science*, 7(5), 477-501.
- CRAGG, P. (1990). *Information Technology and Small Firm Performance*, Unpublished PhD Thesis, Loughborough University of Technology.
- CRAGG, P. and KING, M. (1993). "Small-firm computing: Motivators and inhibitors", *MIS Quarterly*, 17(1), 47-59.
- CRAGG, P. and ZINATELLI, N. (1995). "The evolution of information systems in small firms", *Information & Management*, 29, 1-8.
- CRON, W. and SOBOL, M. (1983). "The relationship between computerisation and performance: A strategy for maximising the economic benefits of computerisation", *Information and Management*, 6, 171-181.
- CROWE, M.; BEEBY, R. and GAMMACK, J. (1996). *Constructing Systems and Information – A process view*, McGraw-Hill, London.
- D'AMBROISE, G. and MULDOWNNEY, M. (1988). "Management theory for small business: Attempts and requirements", *Academy of Management Review*, 13(2), 226-240.
- DAILY, C. and JOHNSON, J. (1997). "Sources of CEO power and firm financial performance: a longitudinal assessment", *Journal of Management*, 23(2), 97-117.
- DANDRIDGE, T. (1979). "Children are not little grown ups: small business needs its own theory", *Journal of Small Business Management*, April, 53-57.
- DE GEUS, A. (1988). "Planning as learning", *Harvard Business Review*, March/April, 70-74.
- DEEKS, J. (1976). *The Small Firm Owner-Manager: Entrepreneurial Behaviour and Management Practice*, Praeger Publisher, New York.
- DELONE, W. (1983). *Determinants of Success for Small Business Computer Systems*, Unpublished PhD Thesis, University of California, Los Angeles.
- DELONE, W. (1988). "Determinants of success for computer usage in small business", *MIS Quarterly*, 12(1), March, 51-61.
- DELONE, W. and McLEAN, E. (1992). "Information systems success: The quest for the dependent variable", *Information Systems Research*, 3(1), 60-95.
- DHILLON, G. (1995). *Interpreting the Management of Information Systems Security*, Unpublished PhD Thesis, London School of Economics and Political Science, University of London.
- DOLL, W. and TORKZADEH, G. (1988). "The measurement of end-use computing satisfaction", *MIS Quarterly*, 12(2), 259-273.
- DOLLINGER, M. (1994). "Measuring effectiveness in entrepreneurial organizations", *International Small Business Journal*, 3(1), 10-20.
- DOTY, D. and GLICK, W. (1994). "Typologies as a unique form of theory building: Toward improved understanding and modelling", *Academy of Management Review*, 19(2), 230-251.
- DOUKIDIS, G.; LYBEREAS, P. and GALLIERS, R. (1996). "Information systems planning in small business: A stages of growth analysis", *Journal of Systems Software*, 33, 189-201.



- DOUKIDIS, G.; SMITHSON, S. and LYBENEAS, T. (1992). "Approaches to computerisation in small businesses in Greece", *Proceedings of the 13th International Conference on Information Systems*, Dallas, December, 139-148.
- DOUKIDIS, G.; SMITHSON, S. and LYBEREAS, T. (1994). "Trends in information technology in small businesses", *Journal of End User Computing*, 6(4), 15-25.
- DUCAN, J. and HANDLER, D. (1994). "The misunderstood role of small business", *Business Economics*, July, 7-12.
- E.I.U. (1995). *Portugal - Country Report, 1st quarter 1995*, The Economist Intelligence Unit, London.
- EARL, M. (1988). "IT and strategic advantage: A framework of frameworks" in EARL, M. (Ed.), *Information Management - The Strategic Dimension*, Clarendon Press, Oxford.
- EARL, M. (1990). "Approaches to strategic information systems planning experience in twenty-one United Kingdom companies", *Proceedings of the 11st International Conference on Information Systems*, Copenhagen, 16-19 December, 271-277.
- EARL, M. (1993). "Experiences in strategic information systems planning", *MIS Quarterly*, 17(1), 1-24.
- EARL, M. and FEENY, D. (1994). "Is your CIO adding value?", *Sloan Management Review*, 35(3), 11-20.
- EASTERBY-SMITH, M.; THORPE, R. and LOWE, A. (1991). *Management Research - An Introduction*, Sage, London.
- EATON, J. and BAWDEN, D. (1991). "What kind of resource is information?", *International Journal of Information Management*, 11, 156-165.
- EDMUNDS, S. (1979). "Differing perceptions of small business problems", *American Journal of Small Business*, 3(4), 1-14.
- EIN-DOR, P. and SEGEV, E. (1978). "Organizational context and the success of Management Information Systems", *Management Science*, 24(10) June, 1064-1077.
- EIN-DOR, P. and SEGEV, E. (1982). "Organisational context and MIS structure: some empirical evidence", *MIS Quarterly*, 6(3), 55-68.
- EPSTEIN, B. and KING, W. (1981). "An experimental study of the value of information", *Omega*, June, 249-258.
- EVANS, G. and NESARY, M. (1991). "Computerizing small business", *Montana Business Quarterly*, 29(3), 2-7.
- FARHOOMAND, A. (1992). "Scientific progress of management information systems" in GALLIERS, R. (Ed.). *Information Systems Research - Issues, Methods and Practical Guidelines*, Blackwell, Oxford.
- FARHOOMAND, F. and HRYCYK, G. (1985). "The feasibility of computers in the small business environment", *American Journal of Small Business*, 9(4), 15-22.
- FEENY, D. and WILLCOCKS, L. (1998a). "Core IS capabilities for exploiting information technology", *Sloan Management Review*, 39(3), 9-12.
- FEENY, D. and WILLCOCKS, L. (1998b). "Re-design the IS function around core capabilities", *Long Range Planning*, 31(3), 354-367.



- FELSTEAD, A. and LEIGHTON, P. (1992). "Issues, themes and reflections on the enterprise culture" in LEIGHTON, P. and FELSTEAD, A. (Eds), *The New Entrepreneurs - Self-employment and Small Business in Europe*, Kogan Page, London, 15-38.
- FINKELSTEIN, S. (1992). "Power in top management teams: Dimensions, measurement and validation", *Academy of Management Journal*, 35, 505-538.
- FRANÇA, L. (1993). *Portugal - Valores Europeus, Identidade Cultural* ("Portugal - European Values, Cultural Identity"), Instituto de Estudos para o Desenvolvimento, Lisbon.
- FRANKE, R.; HOFSTEDE, G.; BOND, M. (1991). "Cultural roots of economic performance: A research note", *Strategic Management Journal*, Special Issue 12, 165-173.
- FRANKFORT-NACHMIAS, C. and NACHMIAS, D. (1992). *Research methods in the social sciences*, Edward Arnold, London.
- FRENCH, J. and RAVEN, B. (1968). "The bases of social power" in CARTWRIGHT, D. and ZANDER, A. (Eds). *Group Dynamics*, Third Edition, Harper & Row.
- FULLER, T. (1996). "Fulfilling IT needs in small businesses: a recursive learning model", *International Small Business Journal*, 14(4), 25-44.
- GABLE, G. (1991). "Consultant engagement for computer systems selection: A pro-active client role in small businesses", *Information & Management*, 20(2), 83-93.
- GABLE, G. (1994). "Integrating case study and survey research methods: an example in information systems", *European Journal of Information Systems*, 3(2), 112-126.
- GALLIERS, R. (1992). "The nature of information systems - Introduction" in GALLIERS, R. (Ed.) *Information Systems Research - Issues, Methods and Practical Guidelines*, Blackwell, Oxford.
- GALLIERS, R. (1997). "Reflections on information systems research: Twelve points of debate", in MINGERS, J. and STOWELL, F. (Eds), *Information Systems: An emerging discipline?*, McGraw-Hill, London, 159-200.
- GALLIERS, R. and LAND, F. (1987). "Choosing appropriate information systems research methodologies", *Communications of the ACM*, 30(11), 900-902.
- GASPAR, J. and WILLIAMS, A. (1991). *North and Central Portugal in The 1990s - A European Investment Region*, London, The Economist Intelligence Unit, Special Report No M604, November.
- GATIAN, A. (1994). "Is user satisfaction a valid measure of systems effectiveness?", *Information & Management*, 26, 119-131.
- GHOSHAL, S. and MORAN, P. (1996). "Bad for practice: A critique of the Transaction Cost Theory", *Academy of Management Review*, 21(1), 13-47.
- GIDDENS, A. (1976). *New Rules of Sociological Method*, Hutchinson, London.
- GILL, J. and JOHNSON, P. (1991). *Research Methods for Managers*, Paul Chapman Publ., London.
- GINZBERG, M. (1981). "Key recurrent issues in the MIS implementation process", *MIS Quarterly*, 5(2), 47-59.
- GLASER, B. and STRAUSS, A. (1967). *The Discovery of Grounded Theory*, Aldine, Chicago.
- GOODHUE, D. (1995). "Understanding user evaluations of information systems", *Management Science*, 41(12), 1827-1844.



- GORDON, W. and KEY, J. (1987). "Artificial intelligence in support of small business information needs", *Journal of Systems Management*, 38(1), 24-28.
- GRANOVETTER, M. (1985). "Economic action and social structure: the problem of embeddedness", *American Journal of Sociology*, 91, 481-510.
- GRANT, R. (1991). "The resource-based theory of competitive advantage: Implication for strategic formulation", *California Management Review*, 33(3), 114-135.
- GREINER, L. (1972). "Evolution and revolution as organizations grow", *Harvard Business Review*, July/August.
- GROVER, V.; TENG, J. and CHEON, M. (1998). "Towards a theoretically-based contingency model of information systems outsourcing", in WILLCOCKS, L. and LACITY, M. *Strategic Sourcing of Information Systems*, Wiley, Chichester, 79-101.
- GUBA, E. and LINCOLN, Y. (1994). "Competing paradigms in qualitative research" in DEZIN, N. and LINCOLN, Y. (Eds), *Handbook of Qualitative Research*, Sage Publications, London.
- HAGMANN, C. and McCAHON, C. (1993). "Strategic information systems and competitiveness: Are firms ready for an IST-driven competitive challenge?", *Information & Management*, 25(4), 183-192.
- HAMEL, G. and PRAHALAD, C. (1994). "Competing for the future", *Harvard Business Review*, 72(4), 122-128.
- HAMEL, G. and PRAHALAD, C. (1996). *Competing for the Future*, Harvard Business School Press, Paperback edition, Boston (Massachusetts).
- HAMILTON, S. and CHERVANY, N. (1981). "Evaluating information systems effectiveness", *MIS Quarterly*, 5(3), 55-69.
- HAMILTON, S. and IVES, B. (1992). "MIS research strategies" in GALLIERS, R. *Information Systems Research - Issues, Methods and Practical Guidelines*, Alfred Waller, Henley-on-Thames.
- HAMPDEN-TURNER, C. (1994). *Corporate Culture*, Piatkus, London.
- HANDY, C. (1976). *Understanding Organizations*, Penguin Books, London.
- HANES, L. and RAMAGE, W. (1977). "Productivity measurement for computing and information systems", *Proceedings of the Ninth Annual Society for MIS Conference*, 81-86.
- HARRÉ, R. (1976). "The constructive role of models" in COLLINS, L. (Ed.). *The Use of Models in the Social Sciences*, Tavistock, London, 16-43.
- HARRÉ, R. (1979). *Social Being: A theory for social psychology*, Blackwell, Oxford.
- HARRÉ, R. (1986). *Varieties of Realism - A Rationale for the Natural Sciences*, Basil Blackwell, Oxford.
- HEIKKILA, J.; SAARINEN, T. and SAAKSJARVI, M. (1991). "Success of software packages in small businesses: An explanatory study", *European Journal of Information Systems*, 1(3), 159-169.
- HERBERG, F. and BRADLEY, J. (1993). "Expert systems development in small business: A managerial perspective", *Journal of Small Business Management*, July, pp.23-34.



- HILL, I. (1987). "An intrapreneur turned entrepreneur compares both worlds", *Research Management*, 30(3), May-June.
- HIRSCHHEIM, R. (1992). "Information systems epistemology: An historical perspective" in GALLIERS, R. (Ed.). *Information Systems Research - Issues, Methods and Practical Guidelines*, Blackwell, Oxford.
- HOFSTEDE, G. (1980). *Culture's Consequences: International Differences in Work-Related Values*, Sage Publications, Beverly Hills.
- HOFSTEDE, G. (1991). *Culture and Organisations*, McGraw-Hill, London.
- HUGHES, J. (1991). *The Philosophy of Social Research*, 2nd edition, Longman, London.
- IACOVOU, C.; BENBASAT, I. and DEXTER, A. (1995). "Electronic Data Interchange and small organisations: Adoption and impact of technology", *MIS Quarterly*, 19(4), December, 465-485.
- IBRAHIM, A. and GOODWIN, J. (1986). "Perceived causes of success in small business", *American Journal of Small Business*, Fall, 41-50.
- IGBARIA, M.; ZINATELLI, N.; CRAGG, P.; CAVAYE, A. (1997). "Personal computing acceptance factors in small firms: A structural equation model", *MIS Quarterly*, 21(3), 279-305.
- INKPEN, A. and CHOUDHURY, N. (1995). "The seeking of strategy where it is not: Towards a theory of strategy absence", *Strategic Management Journal*, 16, 313-323.
- INVERNIZI, B. and REVELLI, R. (1993). "Small firms in the Italian economy: Structural changes and evidence of turbulence" in ACS, Z. and AUDRETSCH, D. *Small Firms And Entrepreneurship: An East-West Perspective*, Cambridge University Press, Cambridge.
- IRISH MANAGEMENT INSTITUTE (1995). *Microcomputers in the Administration and Management Processes in Smaller Business: The Emerging Experience in EEC Countries*, Office for Official Publications of the European Communities, Luxembourg.
- IVES, B. and OLSON, M. (1984). "User involvement in MIS success. A review of research", *Management Science*, 30(5), May, 586-603.
- IVES, B.; OLSON, M. and BAROUDI, J. (1983). "The measurement of user information satisfaction", *Communications of the ACM*, 26(10), 785-793.
- JACKSON, J. and MORGAN, C. (1978). *Organization theory: A macro perspective for management*, Prentice-Hall, Englewood Cliffs.
- JENKINS, A. and RICKETTS, J. (1985). "The development of an MIS satisfaction questionnaire: An instrument for evaluating user satisfaction with turnkey decision support systems", Unpublished working paper, Indiana University.
- JONES, M.; TAYLOR, G. and SPENCER, B. (1995). "The CEO/CIO relationship revisited - An empirical-assessment of satisfaction with IS", *Information & Management*, 29(3), 123-130.
- JOYCE, P.; WOODS, A.; BLACK, S. (1995). "Networks and partnerships: Managing change and competition", *Small Business and Enterprise Development*, 2(1), 11-18.
- KAGAN, A.; LAU, K.; and NUSGART, K. (1990). "Information system usage within small business firms", *Entrepreneurship Theory and Practice*, Spring, 27-37.



- KATZ, R. (1974). "Skills of an effective administrator", *Harvard Business Review*, 52(5), 90-102.
- KAYE, G. (1990). "Information systems successes and failures: research findings from compounding industry", *Journal of Information Technology*, 5, 73-83.
- KEAT, R. and URRY, J. (1975). *Social Theory as Science*, Routledge & Kegan Paul, London.
- KEATS, B. and BRACKER, J. (1988). "Towards a theory of small firm performance: A conceptual model", *American Journal of Small Business*, Spring, 41-57.
- KIERNAN, P. and MORRIS, C. (1994). "Strategic planning and financial performance", *British Journal of Management*, 5(special issue), June, 31-41.
- KIM, K. (1989). "User satisfaction: A synthesis of three different perspectives", *Journal of Information Systems*, Fall, 1-13.
- KING, W., GROVER, V. and HUFNAGEL, E. (1989). "Using information and information technology for sustainable competitive advantage: Some empirical evidence", *Information and Management*, 17, 87-93.
- KLEIN, B. and LEFFLER, K. (1981). "The role of market forces in assuring contractual performance", *Journal of Political Economy*, 89(4), 615-641.
- KLEIN, H. and LYYTINEN, K. (1985). "The poverty of scientism in information systems" in MUMFORD, E. *et al.* (Eds.), *Research Methods in Information Systems*, Elsevier Science Publisher, Amsterdam, 131-159.
- KNIGHTS, D. and MURRAY, F. (1994). *Managers Divided*, John Wiley and Sons, Chichester.
- KOK, C. (1996). "EC update". *European Taxation*, 36(4), EC13-EC16.
- KOTEY, B. and MEREDITH, G. (1997). "Relationships among owner/manager personal values, business strategies, and enterprise performance", *Journal of Small Business Management*, 35(2), 37-64.
- LACITY, M. and JANSON, M. (1994). "Understanding qualitative data: A framework of text analysis methods", *Journal of Management Information Systems*, 11(2), 137-155.
- LAFUENTE, A. and SALAS, V. (1989). "Types of entrepreneurs and firms: the case of new Spanish firms", *Strategic Management Journal*, 10, 17-30.
- LAI, V. (1994). "A survey of rural small business computer use: Success factors and decision support". *Information & Management*, 26(6), 297-304.
- LAMBERT, R. and BYTHEWAY, A. (1998). "Organisational competencies for harnessing IS/IT: Phase two report", Unpublished Research Report, Information Systems Research Centre, Cranfield University.
- LARCKER, D. and LESSING, V. (1980). "Perceived usefulness of information: A psychometric examination", *Decision Sciences*, 11(1), 121-134.
- LAYDER, D. (1993). *New Strategies in Social Research*, Polity Press, Cambridge.
- LEE, A. (1989). "A scientific methodology for MIS case studies", *MIS Quarterly* 13(1), 33-50.
- LEE, A. (1991). "Integrating positivist and interpretive approaches to organizational research", *Organization Science*, 2(4), 342-365.
- LEES, J. (1987), "Successful development of small business information systems", *Journal of Systems Management*, 38(9), 32-39.



- LEES, J. and LEES, D. (1987). "Realities of small business systems implementation", *Journal of Systems Management*, 38(1), 6-13.
- LEFEBVRE, L. and LEFEBVRE, E. (1988). "Computerization of small firms: A study of the perceptions and expectations of managers", *Journal of Small Business and Entrepreneurship*, 5(5), 48-58.
- LEFEBVRE, L.; MASON, R. and LEFEBVRE, E. (1997). "The influence prism in SMEs: The power of CEOs' perceptions on technology policy and its organizational impacts", *Management Science*, 43(6), 856-878.
- LEWIS, J. and WILLIAMS, A. (1986). "Productive decentralization or indigenous growth? Small manufacturing enterprises and regional development in central Portugal", *Regional Studies*, 21(4), 343-361.
- LIEBENAU, J. and BACKHOUSE, J. (1990). *Understanding Information: An Introduction*, MacMillan, Basingtoke.
- LIN, B.; VASSAR, J.; CLARK, L. (1993). "Information technology strategies for small businesses", *Journal of Applied Business Research*, 9(2), 25-29.
- LINCOLN, D. and WARBERG, W. (1987). "The role of microcomputers in small business marketing", *Journal of Small Business Management*, 25.
- LU, M. and FARRELL, C. (1990). "Information systems development in developing countries: An evaluation and recommendations", *International Journal of Information Management*, 10, July, 288-296.
- LYBEREAS, P.; MYLONOPOULOS, N.; DOUKIDIS, G. and GALLIERS, R. (1993). "Information systems planning & entrepreneurial culture in medium-sized enterprises", *Warwick Business School Research Paper No. 91*.
- LYLES, M.; BAIRD, I.; ORRIS, B.; KURATKO, D. (1993). "Formalized planning in small business: Increasing strategic choices", *Journal of Small Business Management*, April, 38-50.
- LYYTINEN, K. and HIRSCHHEIM, R. (1987). "Information Systems failures – a survey and classification of empirical literature", in ZORKOCZY, P. (Ed.). *Oxford Surveys in Information Technology*, Volume 4, Oxford University Press, Oxford, 257-309.
- MALONE, S. (1985). "Computerizing Small Business Information Systems", *Journal of Small Business Management*, 23(2), 10-16.
- MANAGEMENT SERVICES (1996). "New definition for SMEs", *Management Services*, 40(7), 4.
- MANOOCHEHRI, G. (1988). "JIT for small manufacturers", *Journal of Small Business Management*, Oct., 22-30.
- MARKUS, M. (1983). "Power, politics and MIS implementation", *Communications of the ACM*, 26(6), 430-444.
- MARTIN, C. (1989). "Information management in the smaller business: The role of the top management", *International Journal of Information Management*, 9(3), 187-197.
- MARTIN, G. and STAINES, H. (1994). "Managerial competencies in small firms", *Journal of Management Development*, 13(7), 23-35.
- MASON, J. (1996). *Qualitative Researching*, Sage, London.



- MATA, F.; FUERST, W. and BARNEY, J. (1995). "Information technology and sustained competitive advantage: A resource-based analysis", *MIS Quarterly*, 19(4), 487-505.
- MATA, J. (1993). "Small firms in Portuguese manufacturing industry", in ACS, Z. and AUDRETSCH, D. (Eds). *Small Firms and Entrepreneurship: An East-West Perspective*, Cambridge University Press, Cambridge.
- MAY, T. (1993). *Social Research - Issues, Methods and Process*, Open University Press, Buckingham.
- McGOLPIN, P. (1996). *An Examination of the Inter-related Factors and Issues Affecting the Degree of Success with Strategic Information Systems: throughout the application lifecycle*, Unpublished PhD Thesis, Cranfield University.
- McGRATH, R.; MacMILLAN, I. and VENKATARAMAN, S. (1995). "Defining and developing competence: A strategic process paradigm", *Strategic Management Journal*, 16(4), 251-275.
- MEIER, J. (1995). "The importance of relationship management in establishing successful interorganisational systems", *Journal of Strategic Information Systems*, 4(2), 135-148.
- MELONE, N. (1990). "A theoretical assessment of the use-satisfaction construct in information systems research", *Management Science*, 36(1), 76-91.
- MERTON, R. (1968). *Social Theory and Social Structure*, Free Press, New York.
- MILES, M. and HUBERMAN, A. (1994). *Qualitative Data Analysis*, 2<sup>nd</sup> edition, Sage, Thousand Oaks.
- MILES, R. and SNOW, C. (1978). *Organisational Strategy, Structure and Process*, McGraw-Hill, New York.
- MILLER, D. and TOULOUSE, J. (1986). "Strategy, structure, CEO personality and performance in small firms", *American Journal of Small Businesses*, 10(3) Winter, 47-62.
- MILLER, D.; KET DE VRIES, M. and TOULOUSE, J. (1982). "Top executive locus on control and its relationship to strategy, environment and structure", *Academy of Management Journal*, 25(2), 237-253.
- MILLER, J. and DOYLE, B. (1987). "Measuring the effectiveness of computer-based information systems in the financial services sector", *MIS Quarterly*, March, 107-124.
- MINGERS, J. (1997a). "Combining research methods in information systems: Multi-paradigm methodology", *Proceedings of the 5<sup>th</sup> European Conference on Information Systems*, Cork, 19th-21th June, 760-776.
- MINGERS, J. (1997b). "Towards critical pluralism" in MINGERS, J. and GILL, A. *Multi Methodology*, Wiley, Chichester.
- MINGERS, J. and BROCKLESBY, J. (1997). "Multimethodology: Towards a framework for mixing methodologies", *OMEGA, International Journal of Management Science*, 25(5), 489-509.
- MINTZBERG, H. (1979). *The Structuring of Organisations*, Prentice-Hall, Englewood Cliffs.
- MINTZBERG, H. (1991). "The effective organisation. Forces and forms", *Sloan Management Review*, 54, 54-67.
- MINTZBERG, H. (1994). "The fall and rise of strategic planning", *Harvard Business Review*, Jan/Feb., 107-114.



- MONITOR COMPANY and PORTER, M. (1994). *Construir as Vantagens Competitivas de Portugal* ("Building the Competitive Advantages of Portugal"), Forum para a Competitividade, Lisbon.
- MØNSTED, M. (1993). "Regional network processes: networks for the service sector or development of entrepreneurs ?", in KARLSSON, C.; JOHANNISSON, B. and STOREY, D. (1993). *Small Business Dynamics - International, National and Regional Perspectives*, Routledge, London, 205-223.
- MONTAZEMI, A. (1987). "An analysis of information technology assessment and adoption in small business environments", *Journal of Information Systems and Operational Research*, 25(4), 327-340.
- MONTAZEMI, A. (1988). "Factors affecting information satisfaction in the context of the small business environment", *MIS Quarterly*, 12(2), 239-256.
- MUKHOPADHYAY, T.; KEKRE, S. and KALATHUR, S. (1995). "Business value of information technology: A study of Electronic Data Interchange", *MIS Quarterly*, 19(2), June, 137-154.
- MYERS, M. (1997). "Interpretive research in information systems" in MINGERS, J. and STOWELL, F. *Information Systems: An Emerging Discipline*, McGraw-Hill, London.
- NAYLOR, J. and WILLIAMS, J. (1994). "The successful use of IT in SMEs on Merseyside", *European Journal of Information Systems*, 3(1), January, 48-56.
- NAZEM, S. (1990). "Sources of software and levels of satisfaction for small business computer applications", *Information & Management*, 19, 95-100.
- NICKELL, G. and SEADO, P. (1986). "The impact of attitudes and experience on small business computer use", *American Journal of Small Business*, 10, Spring, 37-48.
- O'REILLY, C. (1982). "Variations in decision makers' use of information sources: The impact of quality and accessibility of information", *Academy of Management Journal*, December, 756-771.
- OAKEY, R. (1991). "High technology small firms: Their potential for rapid industrial growth", *International Small Business Journal*, 9(4), 30-42.
- OLAISEN, J. (1990). "Information versus information technology as a strategic resource: areas of application of information and information technology in Norwegian banks and insurance companies", *International Journal of Information Management*, 10, 192-214.
- OLAISEN, J. (1991). "The use of information and information technology as a critical success factor in small and medium-sized companies", *Working paper* 1991/10, Norwegian School of Management, Sandvika, 1-19.
- ORLIKOWSKI, W. J. and BAROUDI, J. J. (1991). "Studying information technology in organizations: Research approaches and assumptions", *Information Systems Research*, 2(1), 1-28.
- ORPEN, C. (1985). "The effects of long-range planning on small business performance. A further examination", *Journal of Small Business Management*, 23(1), 16-23.
- OUTHWAITE, W. (1987). *New Philosophies of Social Science: Realism, Hermeneutics and Critical Theory*, MacMillan, London.
- ÖZCAN, G. (1995). *Small Firms and Local Economic Development*, Avebury, Aldershot.



- PACHE, G. (1990). "The role of small business in the development of network organisation: The case of France", *International Small Business Journal*, 8(4), 71-76.
- PATTON, M. (1987). *How to use qualitative methods in evaluation*, Sage Publications, Newbury Park (California).
- PEPPARD, J. and WARD, J. (1998). "Mind the gap: Diagnosing the relationship between the IT organisation and the rest of the business", *Proceedings of the UK Academy of Information Systems Conference*, Lincoln, April, 150-166.
- PEREIRA, P. and SEABRA, M. (1993). "Identifying vulnerable industries and regions: The proposed European single market and Portuguese manufacturing", *International Regional Services Review*, 16(3), 249-264.
- PETTIGREW, A. and WHIPP, R. (1991). *Managing Change for Competitive Success*, Blackwell, Oxford.
- PETTIGREW, A.; WHIPP, R. and ROSENFELD, R. (1989). "Competitiveness and the management of strategic change processes" in FRANCIS, A. and THARAKAN, P. (Eds), *The Competitiveness of the European Industry*, Routledge, London, 111-136.
- POLLAND, C. and HAYNE, S. (1998). "The changing face of information systems in small firms", *International Small Business Journal*, 16(3), 70-87.
- PORTER, M. and MILLAR, V. (1985). "How information gives you competitive advantage", *Harvard Business Review*, 63(4) July/August, 146-160.
- PORTER, S. (1993). "Critical realist ethnography: The case of racism and professionalism in a medical setting", *Sociology*, 27(4), 591-609.
- PRAHALAD, C. and HAMEL, G. (1990). "The core competence of the corporation", *Harvard Business Review*, May/Jun, 79-91.
- PRATTEN, C. (1991). *The Competitiveness of Small Firms*, Cambridge University Press, Cambridge.
- PYKE, F. (1994). *Small Firms, Technical Services and Inter-Firm Co-operation*, International Institute for Labour Studies, Geneva.
- QSR (1997). *NUD\*IST 4 – Users Guide*, QSR – Qualitative Solutions and Research Pty Ltd, Sydney.
- RAINNIE, A. (1992). "Flexibility and small firms: Prospects for the 1990s" in LEIGHTON, P. and FELSTEAD, A., *The New Entrepreneurs - Self-employment and Small Business in Europe*, Kogan Page, London.
- RAY, C.; HARRIS, T. and DYE, J. (1994). "Small business attitudes towards computers", *Journal of End User Computing*, 4(2), 16-25.
- RAYMOND, L. (1985). "Organizational characteristics and MIS success in the context of small business", *MIS Quarterly*, 9(1), 37-52.
- RAYMOND, L. (1987). "An empirical study of management information systems sophistication in small business", *Journal of Small Business and Entrepreneurship*, 5(1), 38-47.
- RAYMOND, L. (1988). "The impact of computer training on the attitudes and usage behaviour of small business managers", *Journal of Small Business Management*, 26(3), 8-13.



- RAYMOND, L. (1989). "Management information systems: problems and opportunities", *International Small Business Journal*, 7(4), 44-53.
- RAYMOND, L. (1990). "Organisational context and information systems success: A contingency approach", *Journal of Management Information Systems*, 6(4), 5-20.
- RAYMOND, L. and MAGNENAT-THALMANN, N. (1987). "Information systems in small business: Are they used in managerial decisions", *American Journal of Small Business*, 6(4), 20-26.
- RAYMOND, L. and PARÉ, G. (1992). "Measurement of information technology sophistication in small manufacturing businesses", *Information Resources Management Journal*, 5(2), 4-16.
- RAYMOND, L.; BERGERON, F.; GINGRAS, L. and RIVARD, S. (1990). "Problématique de l'informatisation des PME", *Technologies d'Information et Société*, 3(1), 131-148.
- RAYMOND, L.; JULIAN, P.; CARRIÈRE, J.; LACHANCE, R. (1996). "Managing technological change in manufacturing SMEs: A multiple case analysis", *International Journal of Technology Management*, 11(3/4), 270-285.
- REID, G. (1993). *Small Business Enterprise: An Economical Analysis*, Routledge, London.
- RICE, G. and HAMILTON, R. (1979). "Decision theory and the small businessman", *American Journal of Small Business*, 4(1), 1-9.
- RINDFLEISCH, A. and HEIDE, J. (1997). "Transaction cost analysis: Past, present and future applications", *Journal of Marketing*, 61(4), 30-54.
- RIVAS, F. (1989). *Estruturas Organizativas e Informação na Empresa*, Editorial Domingos Barreira, Lisbon.
- RIZZONI, A. (1991). "Technological innovation and small firms: A taxonomy", *International Small Business Journal*, 9(3), June, 31-42.
- ROBINSON, R. (1982). "The importance of outsiders in small firm strategic planning", *Academy of Management Journal*, 25, 80-92.
- ROBINSON, R. and PEARCE, J. (1984). "Research thrust in small firm strategic planning", *Academy of Management Review*, 9(1), 128-137.
- ROMÃO, M. (1998). *Cooperação nas Indústrias Têxteis e do Vestuário: Factores de Sucesso e Tipologia*, Unpublished PhD Thesis, ISCTE (Lisbon).
- ROMÃO, M.; CALDEIRA, M. and O'NEILL, H. (1996). "Co-operative framework for SMEs of the Portuguese textile/clothing supply-chain", *Proceedings of the 4<sup>th</sup> Annual High Technology Small Business Conference*, University of Twente (Holland), 5-6 September, 469-483.
- ROTH, K. (1995). "Managing international interdependence: CEO characteristics in a resource-based framework", *Academy of Management Journal*, 38, 200-231.
- RUMELT, R. (1987). "Theory, strategy and entrepreneurship", in TEECE, D. (Ed.). *The Competitive Challenge*, Ballinger, Cambridge, 137-158.
- SANDERS, G. (1984). "MIS/DSS success measures", *Systems, Objectives, Solutions*, 29-34.
- SAUER, C. (1993). *Why Information Systems Fail: A Case Study Approach*, Alfred Waller, Henley-on-Thames.



- SCHEWE, C. (1976). "The management information system user: An exploratory behaviour analysis", *Academy of Management Journal*, December, 577-590.
- SCHLEICH, J.; CORNEY, W. and BOE, W. (1990). "Pitfalls in microcomputer systems implementation in small business", *ASM Journal of Systems Management*, June, 7-10.
- SCHNEIDER, S. and DE MEYER, A. (1991). "Interpreting and responding to strategic issues: The impact of national culture", *Strategic Management Journal*, 12(4), 307-320.
- SCHULTZ, R. and SLEVIN, D. (1975). "Implementation and organizational validity: An empirical investigation" in SCHULTZ, R. and SLEVIN, D. (eds), *Implementing Operations Research/Management Science*, American Elsevier, 153-182.
- SCHWARTZ, S. (1994). "Beyond Individualism/Collectivism - New Cultural Dimensions of Values" in KIM, U.; TRIANDIS, H.; KAGITÇIBASI, Ç.; CHOI, S. and YOON, G., (Eds), *Individualism and Collectivism Theory, Methods and Applications*, Sage, Thousand Oaks.
- SCOTT, M. and BRUCE, R. (1987). "Five stages of growth in small business", *Long Range Planning*, 20(3), 45-52.
- SCOTT, M. and LEWIS, J. (1984). "Rethinking entrepreneurial failure" in LEWIS, J.; STANWORTH, J. and GIBB, A. (Eds), *Success and Failure in Small Business*, Gower, Hampshire.
- SELZNICK, P. (1957). *Leadership and Administration*, Harper & Row, New-York.
- SENGENBERGER, V.; LOVEMAN, G. and PIORE, M. (1991). *The Remergence of Small Enterprises: Industrial Restructuring in Industrialized Countries*, International Institute of Labour Studies, Geneva (Switzerland).
- SEXTON, D. and VAN AUKEN, P. (1985). "A longitudinal study of small business strategic planning", *Journal of Small Business Management*, January, 7-15.
- SHUMAN, J.; SHAW, J. and SUSSMAN, G. (1985). "Strategic planning in smaller rapid growth companies", *Long Range Planning*, 18(6), 48-53.
- SIMÕES, V. (1996). *Inovação e Gestão em PMEs Industriais Portuguesas* (Management and Innovation in Portuguese Manufacturing SMEs), GEP - Gabinete de Estudos e Planeamento do Ministério da Economia, Lisbon.
- SIMON, H. (1991). "Organisations and markets", *Journal of Economic Perspectives*, 5(2), 25-44.
- SMITH, N. (1967). *The Entrepreneur and his Firm: The Relationship between Type of Man and Type of Company*, East Lansing, Michigan State University.
- SMITH, N. and MINER, J. (1983). "Type of entrepreneur, type of firm and managerial motivation: implications for organisational life cycle theory", *Strategic Management Journal*, 4, 325-342.
- SMITH, P. (1994). "Cross cultural perspectives: Compare management and organisations", *Paper submitted to the workshop of the European Institute for Advanced Study of Management*, Henley Management College, 11-12 November.
- SOLOMON, G. and FERNALD Jr., L. (1993). "Innovative approaches to meeting entrepreneurial information needs: SBA enters the XXI century", *Journal of Creative Behavior*, 27(2), 103-111.



- SØNDERGAARD, M. (1994). "Research Note: Hofstede's Consequences: A study of reviews, citations and replications", *Organizational Studies*, 15(3), 447-456.
- SRINIVASAN, A. (1985). "Alternative measures of system effectiveness: associations and implications", *MIS Quarterly*, September, 243-253.
- STAIR, R.; CRITTENDEN, W.; and CRITTENDEN, V. (1989). "The use, operation and control of the small business computer", *Information and Management*, 16, 125-130.
- STAKE, R. (1994). *The Art of Case Study Research*, Sage, Thousand Oaks.
- STEINER, M. and SOLEM, O. (1988). "Factors for success in small manufacturing firms", *Journal of Small Business Management*, Jan., 51-56.
- STOREY, D. (1994). *Understanding the Small Business Sector*, Routledge, London.
- STOWELL, F; WEST, D.; and STANSFIELD, M. (1997). "Action research as a framework for IS research" in MINGERS, J and STOWELL, F. (Eds). *Information Systems: An emerging discipline?*, McGraw-Hill, London.
- STRAUSS, A. and CORBIN, J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, Sage, Newbury Park.
- SUSMAN, G. and EVERED, R. (1978). "An assessment of the scientific merits of action research", *Administrative Science Quarterly*, 23(4), 582-602.
- SWANSON, E. (1974). "Management information systems: appreciation and involvement", *Management Science*, 21(2), 178-188.
- SYMONS, V. (1990). *Evaluation of Information Systems: Multiple Perspectives*, Unpublished PhD thesis, St Edmonds College, University of Cambridge.
- SZAJNA, B. and SCAMELL, R. (1993). "The effects of information systems user expectations on their performance and perceptions", *MIS Quarterly*, 17(4), 493-514.
- THONG, J. and YAP, C. (1995). "CEO characteristics, organizational characteristics and information technology adoption in small businesses", *OMEGA, International Journal of Management Science*, 23(4), 429-442.
- THONG, J.; YAP, C. and RAMAN, K. (1996). "Top management support, external expertise and information systems implementations in small businesses", *Information Systems Research*, 7(2), 248-267.
- TOBIN, D. (1997). *The Knowledge-Enabled Organisation*, Amacom, New York.
- TREACY, M. (1985). "An examination of a casual model of information systems satisfaction", *Proceedings of the 6th International Conference on Information Systems*, Indianapolis, 16<sup>th</sup>-18<sup>th</sup> December, 285-287.
- TRINDADE, S. (1987). "Foreword in the international seminar on the promotion of technology development in SMEs" in BHALLA, A. (Ed.) (1992). *Small and Medium Enterprises - Technology, Policies and Options*, Intermediate Technology Publications / United Nations.
- TROMPENAARS, F. (1993). *Riding the Waves of Culture*, The Economist Books, London.
- TSOUKAS, H. (1989). "The validity of idiographic research explanations", *Academy of Management Review*, 14(4), 551-561.
- TURNER, J. (1982). "Firm size, performance and computer use", *Proceedings of the 3rd International Conference on Information Systems*, December, 109-120.



- TURNER, J. (1998). "The role of IT in organisational transformation", in GALLIERS, R. and BAETS, W. (Eds). *Information Technology and Organisational Transformation – Innovation for the 21<sup>st</sup> Century Organization*, John Wiley & Sons, Chichester.
- VAITKUS, S. (1994). "The realist image in social science, or a realist's categorization of social thinking ?", *Philosophy of the Social Sciences*, 24(1), 76-83.
- VON KROGH, G. and ROOS, J. (1996). "Arguments on knowledge and competence" in VON KROGH, G. and ROOS, J. (Eds). *Managing Knowledge: Perspectives on Co-operation and Competition*, Sage, London.
- WALSHAM, G. (1993). *Interpreting Information Systems in Organizations*, John Wiley & Sons, Chichester.
- WALSHAM, G. (1995). "Interpretive case studies in IS research: nature and method", *European Journal of Information Systems*, 4, 74-81.
- WARD, J. (1987). "Strategic Information Systems Management" in SOMOGYI, E. and GALLIERS, R. *Towards Strategic Information Systems*, Abacus Press, Kent.
- WARD, J. and GRIFFITHS, P. (1996). *Strategic Planning for Information Systems*, 2nd edition, John Wiley & Sons, Chichester.
- WATSON, J. and EVERETT, J. (1993). "Defining small business failure", *International Small Business Journal*, 11(3), 35-48.
- WATSON, T. (1995). "Entrepreneurship and professional management: A fatal distinction", *International Small Business Journal*, 13(2), 34-46.
- WEILL, P. and BAROUDI, J. (1990). "An empirical investigation of the relationship between firm performance and system success ", Working paper n° 15, University of Melbourne - The Graduate School of Management.
- WELSCH, G. (1986). "The information transfer specialist in successful implementation of decision support systems", *Data Base*, Fall, 32-40.
- WELSH, J. and WHITE, J. (1981). "A small business is not a little big business", *Harvard Business Review*, 59(4), 18-32.
- WHETTEN, D. (1989). "What constitutes a theoretical contribution?", *Academy of Management Review*, 14(4), 490-495.
- WHITLEY, R. (1984). "The scientific status of management research as a practically-oriented social science", *Journal of Management Studies*, 21(4), 369-390.
- WHITTINGTON, R. (1993). *What is Strategy and does it matter?*, Routledge, London.
- WILLCOCKS, L. and LACITY, M. (1998). "The sourcing and outsourcing of IS: Shock of the new?" in WILLCOCKS, L. and LACITY, M., *Strategic Sourcing of Information Systems*, Wiley, Chichester, 1-41.
- WILLIAMS, M. and MAY, T. (1996). *Introduction to the Philosophy of Social Research*, UCL Press, London.
- WILLIAMSON, O. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications*. Free-Press, New-York.
- WILLIAMSON, O. (1979). "Transaction-cost economics: the governance of contractual relations", *Journal of Law and Economics*, 22, 233-261.



- WILLIAMSON, O. (1993). "Calculativeness, trust, and economic organization", *Journal of Law and Economics*, 36, 453-486.
- WILLIAMSON, O. (1996). *The Mechanisms of Governance*, Oxford University Press, New-York.
- WINGHAM, D. and KELMAR, J. (1992). "Factors of small business success strategies", Working paper 92.01, School of Management, Curtin University of Technology.
- WINTER, S. (1988). "On Coase, competence and the corporation", *Journal of Law, Economics and Organization*, 4, 163-180.
- WROE, Brenda (1986). *Contractors and Computers, Why Systems Succeed or Fail - A Grounded Theory Study of the Development of Microcomputer-based Information Systems in Ten Small Companies in the Construction Industry*, Unpublished PhD Thesis, Loughborough University of Technology.
- WYNARCZYK, P.; WATSON, P.; STOREY, D.; SHORT, H. and KEASEY, K. (1993). *The Managerial Labour Market in Small and Medium Sized Enterprises*, Routledge, London.
- YAP, C. and THONG, J. (1997a). "Programme evaluation of a government information technology programme for small businesses", *Journal of Information Technology*, 12(2), 107-120.
- YAP, C. and THONG, J. (1997b). "An impact evaluation of the small enterprise computerisation programme in Singapore", *International Journal of Computer Applications in Technology*, 10(1/2), 51-61.
- YAP, C. and WALSHAM, G. (1986). "A survey of information technology in the UK service sector", *Information and Management*, 10, 267-274.
- YAP, C.; SOH, C. and RAMAN, K. (1992). "Information systems success factors in small business", *OMEGA - International Journal of Management Science*, 20(5-6), 597-609.
- YAP, C.; THONG, J. and RAMAN, K. (1994). "Effect of government incentives on computerisation in small business", *European Journal of Information Systems*, 3(3), 191-20.
- YIN, R. (1993). *Applications of Case Study Research*, Sage Publications, Newbury Park.
- YIN, R. (1994). *Case Study Research*, 2nd edition, Sage Publications, Newbury Park.
- ZORRINHO, C. (1994). "Reengenharia em Portugal: um processo empirico" (Reengineering in Portugal: an empirical process), *Revista PME*, 14, Jul./Sept., 93-96.

## **Appendices**



## *Appendix A*

### **Case Study Structure**

#### ***Check-List***

## **1. General business data (entrepreneur/CEO or another senior manager)**

- 1.1. Year of establishment of the firm;
- 1.2. When did the CEO and other top managers join the firm;
- 1.3. Number of employees;
- 1.4. Major owners of the firm and percentage of capital owned;
- 1.5. Last year's turnover;
- 1.6. Type of products and major owned brands;
- 1.7. Number and type of customers (large/small enterprises, domestic/foreign markets);
- 1.8. Number and type of suppliers (small/large firms, Portuguese/foreign enterprises);
- 1.9. Firm's economic performance (5 - excellent, 4 - good , 3 - reasonable, 2 - weak, 1 - bad);
- 1.10. Financial situation of the firm? (5 - excellent, 4 - good, 3 - reasonable, 2 - weak, 1 - bad);
- 1.11. Major challenges faced by the business and their relative importance (for example: small orders; quick response; demand for better quality products; ecological products; increased competition);
- 1.12. Description of the organisational structure  $\Rightarrow$  (key users);
- 1.13. Generic strategy of the firm (low cost producer; superior quality; focus on a specific market; product specialisation) and why;
- 1.14. Critical Success Factors to accomplish that strategy;
- 1.15. Documents about the firm (financial statements, business reports, IS/IT documents etc);

## **2. Key participants in the process of IS/IT adoption (CEOs, top managers, IS/IT managers)**

- 2.1. Role of the interviewee in the firm, academic qualifications and working experience.
- 2.2. Perspective about the impact of IS/IT in the business and in the industry;
- 2.3. Software available, history of the existing systems and level of satisfaction with those systems (on a scale from 1 to 5): CAD/CAM; EDI; manufacturing planning systems (MRP, MRPII); accounting; payroll; stock control; financial analysis; personnel; invoicing; order management; sales forecasting; other...
- 2.4. How was the software adopted (in-house development, specific software contracted out to software houses, software packages), why.



- 2.5. Methods of systems development and stages followed: IS/IT planning, IS analysis, design, implementation/acquisition, evaluation of business benefits;
- 2.6. People in the organisations involved in the process of IS/IT development (CEO, IS/IT manager, IS/IT staff, senior manager, users) and phase where they were involved (IS/IT planning; IS/IT evaluation; software development acquisition; IS/IT implementation; staff training; maintenance; benefits evaluation);
- 2.7. Who started to be aware of the need to develop IS/IT in the firm (for each system)?
- 2.8. Customers' and suppliers' influence on IS/IT adoption;
- 2.9. Existing hardware: type of computer systems (mainframes, minicomputers or PCs) and printers (number of terminals, type, RAM, hard disk capacity, other specifications). Ask for documents with systems' specifications;
- 2.10. Problems of integration amongst the existing systems and reasons why these problems occur;
- 2.11. Is the firm planning any further IS/IT investment? In which areas and why?
- 2.12. Are IS/IT costs constraining IS/IT investments?
- 2.13. Major benefits obtained, so far, as a result of using computers in the organisation.
- 2.14. What were the expected IS/IT benefits? Were they previously defined? Were those benefits fulfilled?
- 2.15. Major problems found related to the use of computer systems in the organisation;
- 2.16. Resistance to change and conflicts related to the introduction of IS/IT in the organisation and reasons why (power changing hands; people afraid of losing their job; low IS/IT skills, etc);
- 2.17. To what extent did the CEO support the process of IS/IT adoption and use? (scale from 0 to 5: 0 – no support; 1 - bad; 2 - not much involvement; 3- some involvement; 4 - committed; 5 - deeply commitment).
- 2.18. Level of IS/IT expertise of the CEO/top managers;
- 2.19. How frequently does the CEO meet the IS manager. How much time do they spend talking about IS/IT issues? (hours/week). Major issues the CEO is involved in;
- 2.20. Quality of the services provided by IS/IT external consultants/experts: (scale: 0 to 5, for each one: 5 - excellent, 4 - good , 3 - reasonable, 2 - weak, 1 - bad);
- 2.21. Quality of the software available in the market;
- 2.22. Quality of the services provided by IS/IT vendors (scale: 0 to 5, for each one: 5 - excellent, 4 - good , 3 - reasonable, 2 - weak, 1 - bad);
- 2.23. Does the firm have a special relationship with a particular IS/IT vendor or have several IT vendors?

- 2.24. Firm's IS/IT expertise (scale: 0 to 5, for each one: 5 - excellent, 4 - good , 3 - reasonable, 2 - weak, 1 - bad);
- 2.25. How many people in the organisation would be considered IS/IT experts (programmers, analysts, skilled users)?
- 2.26. Qualifications and experience of IS/IT people;
- 2.27. Is the number of IS/IT staff sufficient and well qualified? How would you classify the ability of IT people in the organisation (including IS manager)?
- 2.28. Who selects(ed) IS/IT staff ? What was the selection criteria?
- 2.29. IS/IT training received by employees. Is this time considered sufficient?
- 2.30. Do senior managers feel comfortable using computer systems?
- 2.31. Does the IS/IT manager understand the strategic issues and goals of the business?
- 2.32. Does the IS/IT manager participate in business planning (formal or informal)?
- 2.33. Interviewee level of satisfaction with the performance of the existing computer systems (4 - very satisfied; 3 – satisfied; 2 – slightly unsatisfied; 1 – not satisfied) and why.
- 2.34. Major factors related to IS/IT success (or unsuccess). Order the relative importance of those factors (1- most important, ..., less important).

### **3. Users (other senior managers - finance, manufacturing, marketing managers)**

- 3.1. Role in the firm;
- 3.2. Years in the firm;
- 3.3. Own use of IS/IT;
- 3.4. Time spent with the use the computer system (average hours/month);
- 3.5. Hours/month used to discuss IS/IT related subjects;
- 3.6. Participation in decisions about the use of IT in the firm;
- 3.7. Evaluate own contribution to the use of IT in the firm;
- 3.8. Opinion about the potential impact of computer systems in the business/industry;
- 3.9. Major benefits which were obtained, so far, as a result of using computers in the organisation;
- 3.10. Level of satisfaction with the performance of IS/IT? (1 to 4; 4 - very satisfied; 3 – satisfied; 2 – slightly unsatisfied; 1 – not satisfied)
- 3.11. Opinion about the major problems related to the use of computer systems in the organisation;



- 3.12. What do you think is important to achieve IS/IT success (IS/IT satisfaction)?
- 3.13. Did IS/IT adoption in the firm have an impact in the way power is distributed?

#### **4. IS/IT suppliers or IS/IT external consultants**

- 4.1 Years of experience;
- 4.2 Type of software provided;
- 4.3 Perspective of SMEs as clients;
- 4.4 Examples of successful/unsuccessful IS/IT adoption and use by manufacturing SMEs;
- 4.5 Role of the key participants in the process of IS/IT adoption and use (CEO, IS/IT manager, IS/IT staff, senior managers, etc);
- 4.6 Identification of factors perceived as enablers or inhibitors of IS/IT success.

## **Appendix B**

### **The questionnaire**

**(original in Portuguese and English translation)**



## Inquérito sobre sistemas e tecnologias da informação em PMEs industriais

Nome: \_\_\_\_\_ Empresa: \_\_\_\_\_

1. Indique, por favor, em qual das opções apresentadas se enquadra melhor o seu grau de satisfação com o desempenho dos sistemas informáticos na empresa. Se estes estiverem em fase de implementação assinale com uma cruz no local indicado e refira o seu grau de satisfação com o processo de implementação considerando apenas as expressões sublinhadas nas opções.

### 1.1 Sistemas administrativos (contabilidade, salários, facturação, etc.):

*Em fase de implementação* ☐

- a) Completamente satisfeito com a informação produzida. ☐
- b) Satisfeito com a informação produzida apesar de o sistema poder ser melhorado. ☐
- c) Ligeiramente insatisfeito com a informação produzida, existem alguns pequenos problemas. ☐
- d) Insatisfeito com a informação produzida. ☐
- e) Não possuo dados para responder. ☐
- f) Não aplicável (o sistema não existe). ☐

### 1.2 Sistemas de gestão de stocks:

*Em fase de implementação* ☐

- a) Completamente satisfeito com a informação produzida. ☐
- b) Satisfeito com a informação produzida apesar de o sistema poder ser melhorado. ☐
- c) Ligeiramente insatisfeito com a informação produzida, existem alguns pequenos problemas. ☐
- d) Insatisfeito com a informação produzida. ☐
- e) Não possuo dados para responder. ☐
- f) Não aplicável (o sistema não existe). ☐

### 1.3 Sistemas de planeamento e controlo da produção:

*Em fase de implementação* ☐

- a) Completamente satisfeito com a informação produzida. ☐
- b) Satisfeito com a informação produzida apesar de o sistema poder ser melhorado. ☐
- c) Ligeiramente insatisfeito com a informação produzida, existem alguns pequenos problemas. ☐
- d) Insatisfeito com a informação produzida. ☐
- e) Não possuo dados para responder. ☐
- f) Não aplicável (o sistema não existe). ☐

#### **1.4- CAD/CAM:**

*Em fase de implementação* ☐

- a) Completamente satisfeito com a informação produzida. ☐
- b) Satisfeito com a informação produzida apesar de o sistema poder ser melhorado. ☐
- c) Ligeiramente insatisfeito com a informação produzida, existem alguns pequenos problemas. ☐
- d) Insatisfeito com a informação produzida. ☐
- e) Não possuo dados para responder. ☐
- f) Não aplicável (o sistema não existe). ☐

#### **1.5- Sistemas de transferência electrónica de dados (EDI, e-mail, etc)**

*Em fase de implementação* ☐

- a) Completamente satisfeito com a informação produzida. ☐
- b) Satisfeito com a informação produzida apesar de o sistema poder ser melhorado. ☐
- c) Ligeiramente insatisfeito com a informação produzida, existem alguns pequenos problemas. ☐
- d) Insatisfeito com a informação produzida. ☐
- e) Não possuo dados para responder. ☐
- f) Não aplicável (o sistema não existe). ☐

2. Diga, por favor, qual é em sua opinião a importância relativa dos sistemas informáticos existentes para o negócio da empresa. Ordene os sistemas por ordem decrescente de importância (1, 2, 3, ...) atribuindo o valor "1" aquele que considera **mais importante**:

- a) Sistemas administrativos (contabilidade, salários, facturação, etc.) ☐
- b) Sistemas de gestão de *stocks*: ☐
- c) Sistemas de suporte à produção (planeamento, controlo, etc): ☐
- d) CAD/CAM: ☐
- e) *Software* para transferência electrónica de dados (EDI, e-mail): ☐

3. Globalmente, como classifica o seu grau de satisfação com o desempenho dos sistemas informáticos da empresa ?

- a) Muito satisfeito ☐
- b) Satisfeito ☐
- c) Ligeiramente insatisfeito ☐
- d) Insatisfeito ☐

*Muito obrigado pelas suas respostas.*



## Questionnaire on information systems and information technology in manufacturing SMEs

Name: \_\_\_\_\_ Firm: \_\_\_\_\_

1. In which of the following options would you rate your level of satisfaction with the performance of IS/IT in the firm. If the computer-based information system is being implemented, please tick the appropriate box, refer to your degree of satisfaction with the implementation process and consider only the statements underlined.

### 1.1 Administrative systems (accounting, payroll, invoicing, ...):

*Being implemented* ☐

- a) Completely satisfied with the information produced by the system
- b) Satisfied with the information produced, although the system can be improved
- c) Slightly unsatisfied with the information produced, there are some problems
- d) Unsatisfied with the information produced
- e) I do not have enough data to answer the question
- f) Not applicable (the system does not exist).

☐  
☐  
☐  
☐  
☐  
☐

### 1.2 Stock management systems:

*Being implemented* ☐

- g) Completely satisfied with the information produced by the system
- h) Satisfied with the information produced, although the system can be improved
- i) Slightly unsatisfied with the information produced, there are some problems
- j) Unsatisfied with the information produced
- k) I do not have enough data to answer the question
- a) Not applicable (the system does not exist).

☐  
☐  
☐  
☐  
☐  
☐

### 1.3 Manufacturing planning and control:

*Being implemented* ☐

- l) Completely satisfied with the information produced by the system
- m) Satisfied with the information produced, although the system can be improved
- n) Slightly unsatisfied with the information produced, there are some problems
- o) Unsatisfied with the information produced
- p) I do not have enough data to answer the question
- a) Not applicable (the system does not exist).

☐  
☐  
☐  
☐  
☐  
☐

#### **1.4- CAD/CAM:**

*Being implemented* ☐

- q) Completely satisfied with the information produced by the system ☐
- r) Satisfied with the information produced, although the system can be improved ☐
- s) Slightly unsatisfied with the information produced, there are some problems ☐
- t) Unsatisfied with the information produced ☐
- u) I do not have enough data to answer the question ☐
- a) Not applicable (the system does not exist). ☐

#### **1.5- Interorganisational information systems (EDI, e-mail, etc)**

*Being implemented* ☐

- v) Completely satisfied with the information produced by the system ☐
- w) Satisfied with the information produced, although the system can be improved ☐
- x) Slightly unsatisfied with the information produced, there are some problems ☐
- y) Unsatisfied with the information produced ☐
- z) I do not have enough data to answer the question ☐
- a) Not applicable (the system does not exist). ☐

2. In your opinion, what is the relative importance for the business of the existing computer-based information systems. Please, classify the following systems by descendent order of importance (1, 2, 3, ...) given the value "1" to the one that you assess as more important:

- a) Administrative systems (accounting, payroll, invoicing, etc.) ☐
- b) Stocks management systems ☐
- c) Manufacturing support systems ☐
- d) CAD/CAM: ☐
- e) Interorganisational information systems (EDI, e-mail): ☐

3. Globally, how would you rate your level of satisfaction with the performance of IS/IT in the organisation?

- a) Very satisfied ☐
- b) Satisfied ☐
- c) Slightly unsatisfied ☐
- d) Unsatisfied ☐

*Thank you for your answers.*